Build It: Bitty Bomber

AMA President Talks NPRM

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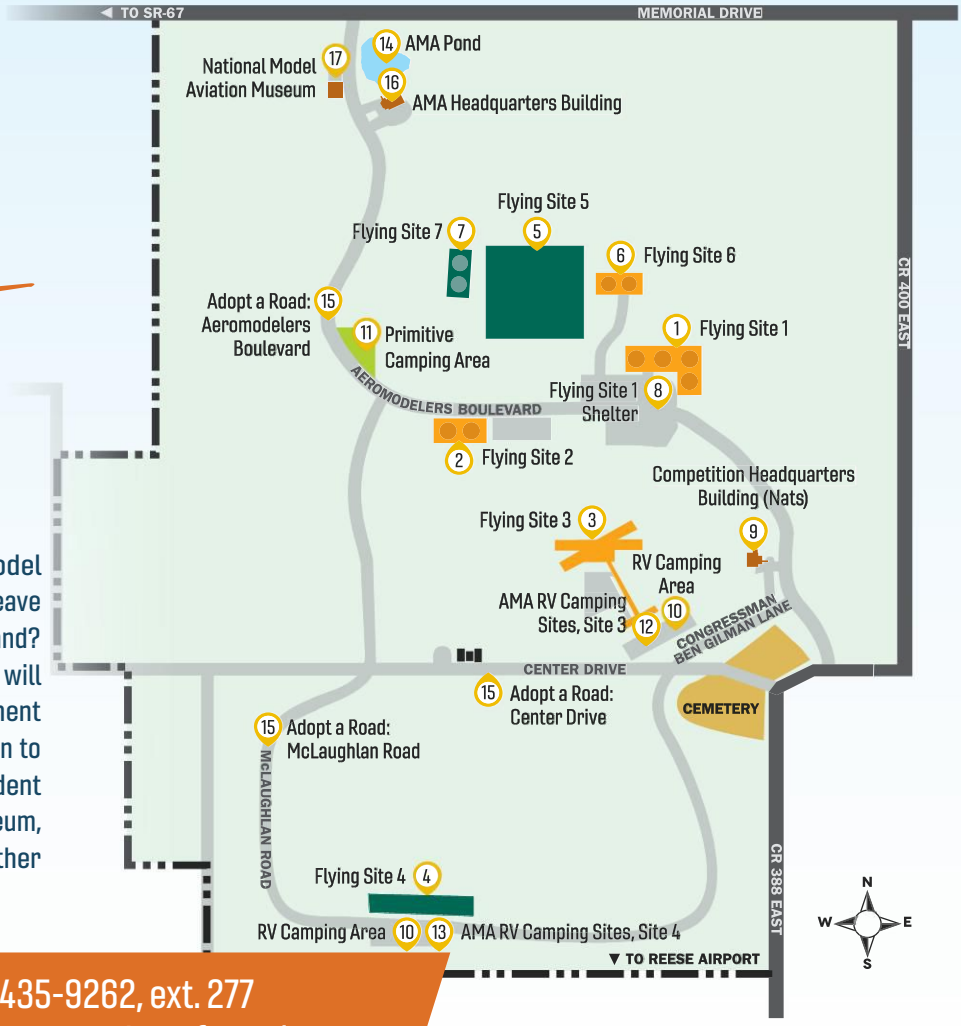

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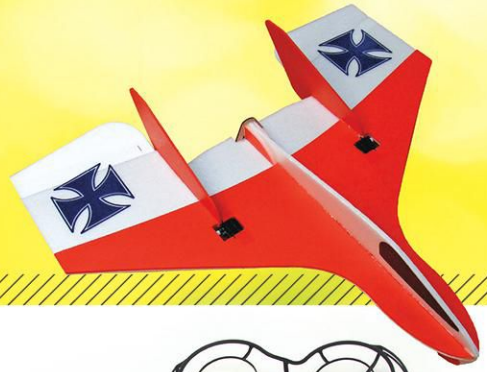

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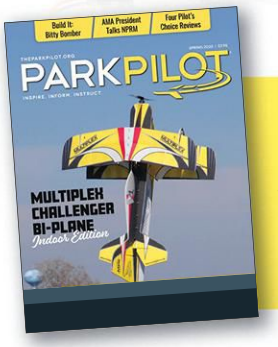

>> ON THE COVER:

The colorful Multiplex Challenger Bi-Plane Indoor Edition throws Bernoulli's principle out the window and is a triumph of brute physics over elegant aerodynamics. Its inherent stability, yet high maneuverability, make it a fun airplane with which to try out new flying techniques.

Photo by Fitz Walker.

CONTROL TOWER

Jay Smith jays@modelaircraft.org

Would 8 more ounces make a difference? When the Park Pilot Program was launched in 2008, the goal was to set guidelines for aircraft that could be safely flown in a typical park-type setting. One of the guidelines was that the aircraft would weigh no more than 2 pounds.

At times, I have found that having the additional 8 ounces—or half pound—made the difference between using a larger battery, flying with scale ordnance, or meeting the guidelines with a retractable gear-equipped model would be possible with the added weight allowance.

I also have to consider whether the extra weight would preclude me from flying in the same space in which I can comfortably fly a 2-pound model. I feel confident that this would not be an issue, but obviously, we have to draw the line at some point.

I would very much like to know your thoughts about the benefits of raising the weight limit to 2.5 pounds, and hear any concerns that you might have. Please don't hesitate to send me an email and let me know what you think! »

Would 8 more ounces make a difference?

PARKPILOT
SPRING 2020
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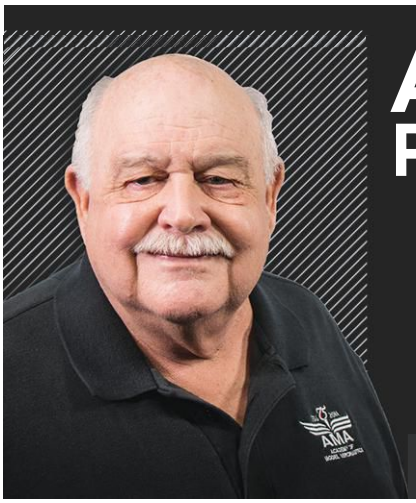

AMA PRESIDENT

Rich Hanson richh@modelaircraft.org

By now I'm sure most have heard that on December 31, 2019, the FAA published its NPRM (Notice of Proposed Rulemaking) for the "Remote Identification of Unmanned Aircraft Systems." If you've read through the proposal, you realize that this is a complicated and complex rule, and on its face, is extremely problematic for the aeromodeling community. But, what does it mean for the Park Pilot Program community?

First, you need to understand that at this point, it's only a *proposed* rule. The publication of the NPRM allowed for a 60-day public comment period and I hope that most of you, if not all, responded to the call for public comment. More than 50,000 comments were submitted before the comment period closed on March 2.

After the public comment period closed, the FAA was expected to begin to review and evaluate the comments, prepare a response, and possibly adjust the rule based upon its review of the comments. This process could take roughly 18 to 24 months, if not longer. Once completed, the FAA will publish a Final Rule and institute an implementation period that will establish the final timeline by which the rule becomes regulation and requires compliance.

The intent of the rule is to provide a framework for remote identification of all UAS operating in the US airspace.

The proposed rule would impose operating requirements on those flying unmanned aircraft, including models, that are registered with the FAA. The new rule would also require that all model aircraft weighing more than 0.55 pounds be registered, replacing current regulation which allows modelers to pay a flat fee of $5 to register.

Identifying where and how Park Pilot Program enthusiasts will be able to continue to fly is where the proposed rule becomes very complex and convoluted. For the most part, it's assumed that pilots will continue to be able to operate at most AMA flying sites (FAA-recognized identification areas; FRIAs) and in areas where compliant aircraft are flown no farther than 400 feet from the pilot.

The NPRM process could take 2 to 3 years before the rule is fully implemented. And throughout the process, the proposed rule is subject to further changes and possible congressional intercession.

AMA is committed to keeping you informed and will keep you apprised of any changes as the process continues. For now, AMA wants Park Pilot Program members to fly safely, responsibly, and continue to operate within AMA's community-based safety program. Continue to be respectful of your neighbors, your community, and other visitors. And, most importantly, continue to enjoy this creative hobby. »

THEPARKPILOT.ORG ONLINE BUZZ

Find more great content online and in your digital edition!

Bitty Bomber

» You can build the Bitty Bomber, based on the Lanzo Bomber, with free plans available to download at theParkPilot.org.

Fly More

» Get more bang for your buck with the DJI Mini Fly More Combo. Watch the multirotor take flight in a video.

Upsized Ranger

» FMS has released a larger version of its high-wing Ranger as a Plug-N-Play and with a 33.5-inch wingspan. Find out how this foamie flies in a video.

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JOIN THE CONVERSATION

MAY 27–AUGUST 5, 2020

The 2020 AMA Nats will be held in Springerville, Arizona (Indoor Free Flight), and at the IAC (International Aeromodeling Center) in Muncie, Indiana. Although Park Pilot Program members are ineligible to compete, everyone is invited to attend and watch the aerial artistry unfold. The Nats is the world's largest contest for flyable model aircraft, and the competition includes events in the categories of Free Flight, Control Line, RC, and Scale. For specific event details, contact AMA at (800) 435-9262.
modelaircraft.org/nats

JUNE 7–13, 2020

Are you—or do you know someone who is—between the ages of 13 and 17 this year and wants to learn or work on flying skills? The all-new Camp AMA is a weeklong summer camp for teenagers, held at the IAC in Muncie. Camp AMA accepts applicants between the ages previously stated, with skill levels ranging from beginner to advanced. Campers get a chance to work with AMA flight instructors who are well known in the RC hobby and industry. They will help the campers improve their techniques and use their expertise to train and teach the participants in all aspects of the RC hobby. For more information, visit the Camp AMA webpage or contact the AMA Education department at education@modelaircraft.org.
amaflightschool.org/campama

JUNE 24–28, 2020

MultiGP, an AMA Special Interest Group for FPV racing, announces the 2020 MultiGP International Open, a gathering of FPV pilots from around the world. This fun-fly, festival, and contest takes place at the IAC in Muncie and features flying and racecourses for all skill levels and disciplines.

In addition to the world's best FPV pilots competing in the World Cup, there is Spec racing, rookie and freestyle courses, wing racing, team racing, a night-flying course, Tiny Whoop racing, vendors showing off the latest and greatest technology, FPV-related workshops, and more. Visit MultiGP's website for more information.
multigp.com/event/2020-multigp-international-open

AUGUST 5–9, 2020

The IRCHA (International Radio Controlled Helicopter Association) Jamboree, is one of the world's largest RC helicopter events, with pilots attending from the US and other countries. Held at the IAC in Muncie, the IRCHA Jamboree features RC helicopters ranging from ultramicro size to scale, as well as vendors, noon demonstrations, Power Hours by manufacturers and distributors, and competitions. The Saturday evening night-flying competition is not to be missed. Free to spectators; pilots must be AMA members.
ircha.org

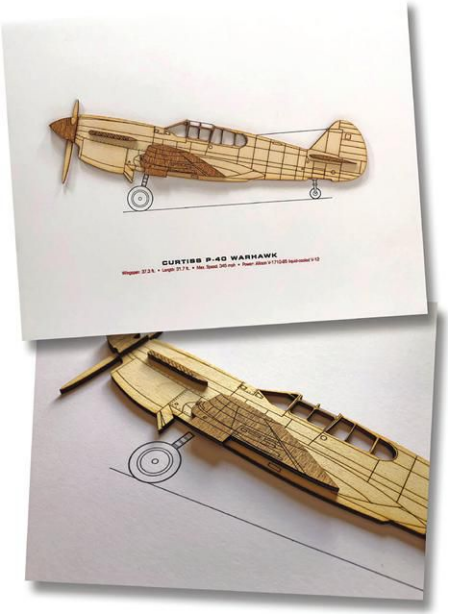
AUGUST 15, 2020

National Model Aviation Day is one day each year when aeromodelers should celebrate the joy of flying. Clubs are encouraged to hold events that day and invite the public out to learn more about the hobby, and in many cases, try it. National Model Aviation Day events can also be a way to give back. This year, clubs are encouraged to raise money for the AMA Foundation.
modelaviationday.com

Knife Edge Software

acrofs.com

Knife Edge Software, the company behind the RealFlight RC simulator, and Jim Bourke Airshows, have updated the **Acro FS** aerobatic flight simulator with new aircraft and new flying sites that can be tried for free with Steam Early Access. Acro FS is the world's most realistic simulation of aerobatic flight, with stick-and-rudder pilots in mind. Users with gaming computers can fly in virtual reality using Oculus or SteamVR headsets. Pilots can choose from one of four full-scale aircraft: a Super Decathlon, Yak-54, Sbach 342, or Extra 330SC. They can be flown at four locations: Borrego Valley Airport in Borrego Springs, California; Flight School; Homestead; and Joe's Garage. Also included are high-speed racing and environmental controls such as wind, precipitation, and daylight. A 64-bit Intel i5, AMD Ryzen 1500, or equivalent processor; Windows 7, 8, or 10 operating system with 2 to 4 GB RAM; DirectX 11 midrange video card with 2 GB of video memory; and 4 to 6 GB available storage space are required and recommended.



Old School Model Works

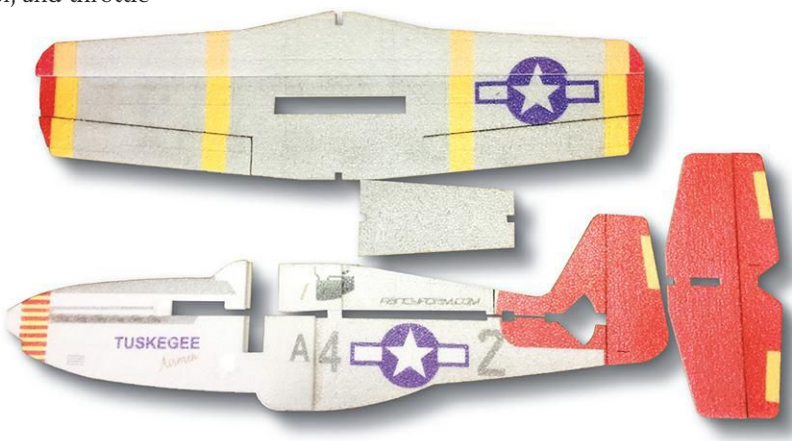
oldschoolmodels.com

Old School Model Works has combined 1/8-inch precision-cut, birch plywood with a printed backing to create unique **WW2 Aircraft Profiles** ($19.95) that look great in any home, office, or hangar! The multilayered technique results in artwork that appears to "pop off" of the print with a 3D effect. Specifications for each type of aircraft (wingspan, length, maximum speed, and engine details) are printed below its name. Each piece measures 11 x 14 inches and is mounted on a sturdy foam-board backer. Display the artwork as is or frame it for an elegant way to brighten any room. Some of the profiles that are currently available are the Boeing B-17G Flying Fortress, Chance-Vought F-4U Corsair, Curtiss P-40 Warhawk, Gee Bee R-1 Sportster, North American F-86 Sabre, Vickers Supermarine Spitfire, and North American P-51D Mustang. Check the website for additional profiles.

Fancyfoam Models

fancyfoam-com.3dcartstores.com

The EzFly kit was designed as a trainer airplane. It is a fun, easy-flying airplane that can be flown indoors or outdoors, and has smooth, docile flying characteristics with a dihedral wing and rudder, elevator, and throttle controls to make it simple for a beginner to understand. It can even be flown at walking speed. The nose of the 31-inch wingspan **EzFly P-51 Kit** (Part Number Trainer007; $35-$55) is triple-thick EPP foam, and the motor is mounted mid-airplane to minimize damage from crashes. If the foam breaks or tears, it only takes a little glue to get it back in the air. Construction is easy using alignment tabs. Available in white, printed blue and silver, or with a red tail, the EzFly P-51 kit includes laser-cut foam parts with the bevels and spar slots finished, as well as a hardware pack containing the spar, pushrods, control horns, and motor mounts. A propeller, prop-saver bands, motor, ESC, receiver, servo, battery, and glue are available on the Fancy Foam Models website, as well as an optional aileron kit. More details are available on the EzFly thread on RCGroups.com (bit.ly/37jcDha).



Blade

horizonhobby.com/content/bladehelis

The **Blade Fusion 360** (BLH5250; $549.99) is the next generation of the Fusion helicopter series. Blade has redeveloped its popular 360-size helis for improved performance by adding high-end hardware, a new flybarless controller, all carbon-fiber aluminum construction, an improved power system package, and more. Spektrum technology is featured throughout the heli, including new Spektrum 3055 and 3065 servos with Optimized Servo Geometry and a Spektrum 6250 HX flybarless system with advanced adaptive flight control algorithms, forward programming, a six-axis M.E.M.S. inertial sensor, two remote ports for diversity, and more. A Hobbywing 60-amp Platinum ESC is preinstalled and preprogrammed and ready for 6S power. The 2221 1,800 Kv brushless outrunner motor delivers impressive headspeeds via the helical main gear. The Fusion 360 accepts a wide range of 22.2-volt LiPo batteries from 1,300 mAh to 1,800 mAh. Rounding it out, the eye-catching, expertly painted fiberglass canopy and matching tail fin are easy to see in the sky.

Sullivan Products

sullivanproducts.com

Marcy Jones invented Marcy's Wheel Chocks in 2003 and has tested and perfected them ever since! **Marcy's Mini Wheel Chocks** (S841; $7.88) are designed for tires of up to 2.5 inches. Depending on the wheel size and gear angle, the chocks can fit either inside or outside of the tires and will accommodate most axle sizes. Sold in pairs, the chocks have many great benefits, including maximizing the security and safety of aircraft during transport, conserving space in trailers, trucks, vans, and storage areas, eliminating flat spots on tires, and preventing the aircraft from rolling during hardware or radio installations. Made of high-strength, anodized aluminum for a lifetime of use, Marcy's Mini Wheel Chocks can be used with any type of airplane—whether a tail-dragger or equipped with tricycle landing gear.

Retro RC

retrorc.us.com

The original 1951 Flying Wing was powered with a Top Flite Wasp .049 engine. The **Retro RC 1951 Flying Wing** ($87) can be powered with a radial-mounted .049 to .09-size glow or diesel engine, or a backplate-mounted Speed 300 to 400-size electric motor, 250 racing quadcopter motor, E36, or similar size electric motor for quiet, clean flights. Retro RC's prototype weighed 13 ounces using a 75-watt 2203 2,300 Kv motor. To build for RC, two "skinny" wing-mount servos that are approximately 9 mm to 10 mm thick are required. Use a folding propeller or mount a wire skid on the firewall as a prop-saver for fixed propellers.

The 3/4 views of the Bitty Bomber show its diminutive size, simple construction, and the OT lines of Chet Lanzo's original Bomber from 1938.

Build It

BITTY BOMBER

by Larry Kruse | Photos by Larry Kruse | aircats@att.net

One of the most iconic OT (Old-Timer) model airplanes ever designed is the Lanzo Bomber. It originated in 1938 as one of an incredible string of outstanding airplanes by Chet Lanzo. It's safe to speculate that more SAM (Society of Antique Modelers; antiquemodeler.org) RC competitions have been won by Lanzo Bombers than any other design.

Although it is somewhat ungainly and almost stubby in appearance, its glide is unsurpassed in all categories and all sizes. The interesting thing about the Lanzo Bomber is that it was rarely mentioned in the modeling press of its day and did not achieve the same degree of popularity that many of Chet's other designs did with modelers of that time. It could be that the original 8-foot wingspan of the airplane (scaling up or down was not permitted at that time) made it too cumbersome to haul around in the era before station wagons and SUVs.

It was only after the advent and increasing popularity of OT RC-assisted models was promulgated by SAM modelers that the Bomber surfaced as one of the best designs for Texaco and Limited Engine Run events, thanks largely to the rules that permitted the scaling of models up or down to match specific engine displacements.

Now, approximately 82 years since its origin, the Lanzo Bomber ranks as one of the outstanding model designs of that era—and a terrific choice for today's sport modelers who want an airplane that is a good-gliding Sunday flyer, irrespective of its size.

I recently acquired some micro RC components from a fellow club mate, and it occurred to me that a foam, micro, "bitty" Lanzo Bomber might be just the airframe that these components needed. It didn't take long to gather some Depron foam scraps and head to the drawing board.

Essentially, any micro control and power elements or their equivalents can be used to get the airplane in the air. I had on hand a Tactic 1424 four-channel receiver/servo/ESC combination board, a GPFLZA6318 7 mm brushed motor with a 6.25:1 gearbox, a 140 mAh single-cell LiPo battery, and a 4.5-inch propeller. Any of the smaller Horizon Hobby (horizonhobby.com) or Banggood (banggood.com) components that are currently available, or "harvested" components from out-of-service micro airplanes, could be used. Because it's not a 3D airplane, mild to moderate power is sufficient.

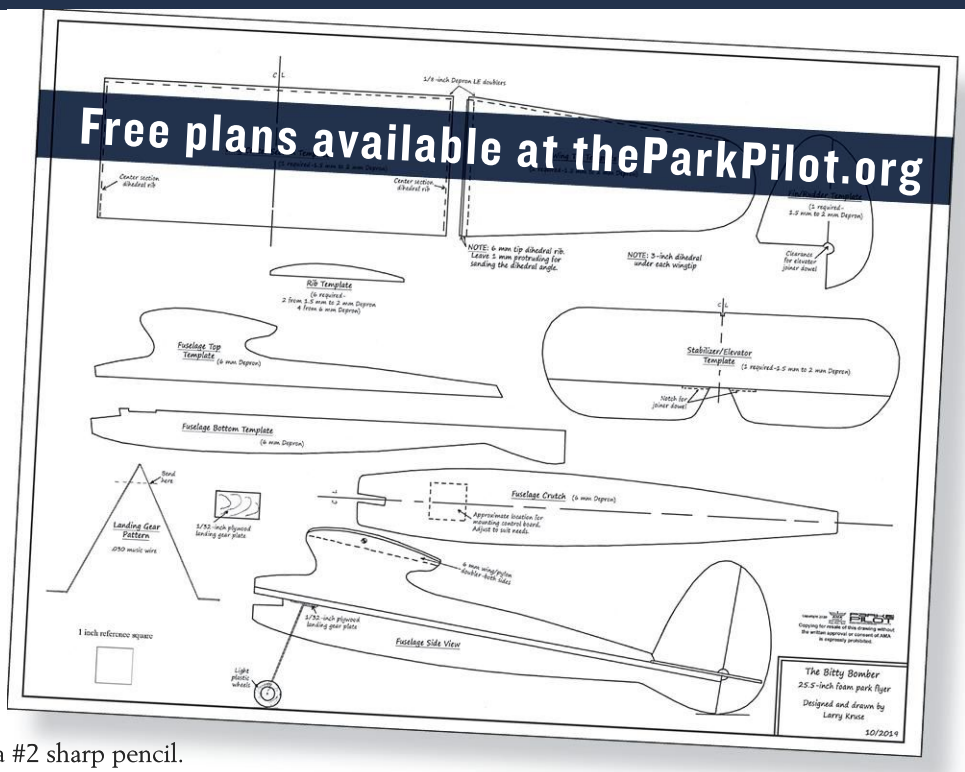
I'm aware that the gold standard of sheet foam, Depron, is hard to find in the US; however, Great Planes Pro-Formance foam (greatplanes.com) can

be found. Micron Wings (micronwings.com) in Queensland, Australia, is a reliable source of Depron if your stash has run out. I've been using the Micron Wings Small Size Depron Sheets packets for some time, and the shipping won't break the bank. Delivery is usually within 10 days to two weeks.

The Bitty Bomber uses 1.5 mm to 2 mm Depron for the flying surfaces and 6 mm Depron for the fuselage pieces. Additionally, you will need a 12-inch length of .030 music wire for the landing gear, two 12-inch pieces of .020 music wire for the elevator and rudder pushrods, and a scrap of $^1/_{32}$-inch plywood for the landing gear mounting plate.

I used a pair of discarded, lightweight plastic wheels that probably came from an RTF FF (Free Flight) model to complete the undercarriage. Du-Bro (dubro.com) micro control horns were used for the elevator and rudder. Trimmed-down Flyzone micro horns were used as pushrod standoffs.

General construction notes: The accompanying drawings are templates for the full-size parts. For what few basic pieces and parts are required, the easiest method is to attach the plans to lightweight poster board with a glue stick or rubber cement and cut the parts out with scissors. They can then be used as patterns to trace onto the specified foam thicknesses using a light touch and a #2 sharp pencil.

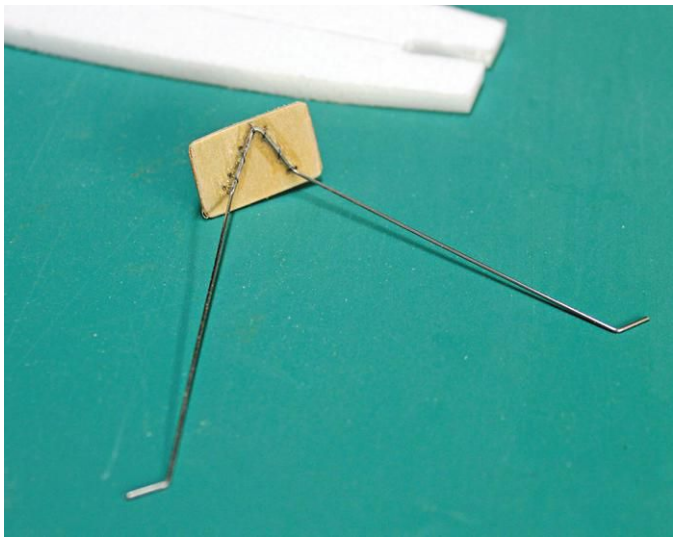


Although the lines would be more distinct, do not use a ballpoint pen to trace the parts. It leaves too much residue that shows up later as dark blotches and is hard to remove.

I've found that a self-healing cutting mat from a craft store works well as a base on which to cut foam. I use a #11 scalpel blade as the cutting tool, knowing that as work progresses, I will need to re-sharpen the point on it several times to keep it from tearing the foam on the bottom side of a cut. An X-Acto knife with a #11 blade would work just as well I suspect, as long as the comment about resharpening it is heeded as you go along.

After the parts are cut out from foam sheet that is the appropriate thickness, gently true up any raggedness on the edges using fine sandpaper that is wrapped around a block or attached to a T-bar sander.

Most of the airplane is built using bSi (Bob Smith Industries; bsi-inc.com) Super Gold foam-safe CA, unless otherwise noted. I also used hot glue to mount the motor and control units and 5-minute epoxy for the landing gear plate/fuselage crutch joint and the wing/pylon joint.



The landing gear is bent from .030 music wire and sewn and glued with CA adhesive to the 1/32-inch plywood plate, as shown.

Assembling the fuselage: After the 6 mm fuselage crutch (so named because of its shape) is cut out, draw a centerline the length of the piece, both top and bottom. After the fuselage top and bottom vertical pieces are cut out, test-fit them to the centerline of the fuselage crutch to ensure that they will be at right angles to that horizontal piece, and that a cruciform shape in the front or rear profile will be maintained.

Note that the motor thrustline is set in place (both down and right thrust) by the notches in the fuselage crutch and the bottom fuselage piece. You might have to adjust the width and length for your motor choice. Check to make sure that those notches are accurately cut and that they point to the right and down—not to the left and up!

Notch out the relief cutout for the plywood landing gear plate in the bottom fuselage piece. If you want to install your control board as I did, you will need to cut a larger clearance hole in the bottom fuselage piece in the area noted on the plans. Similarly, you also might want to cut a hole in the crutch

SPECIFICATIONS:

MODEL TYPE: Foam park flyer
SKILL LEVEL: Beginner/intermediate
WINGSPAN: 25.5 inches
LENGTH: 14.25 inches
WING AREA: 90 square inches (nominally)
WEIGHT: 37 grams (without battery)
WING LOADING: 2.4 ounces per square foot
POWER: Flyzone 7 mm brushed motor and gearbox
PROPELLER: 4.5-inch propeller
BATTERY: 1S 140 mAh LiPo
RADIO EQUIPMENT: Tactic 1424 four-channel receiver; Tactic TTX850 transmitter
FLIGHT DURATION: 5 to 7 minutes, depending on throttle management

The airplane is constructed from 6 mm Depron foam for the fuselage and 1.5 mm to 2.0 mm Depron for the flying surfaces. Full-size templates included with the plans provide guidance.

The wing's center section and the wingtips have scrap doublers glued to the LEs to reduce flying and hangar rash. Note the undercamber in the surfaces, which should be bent in before the doublers are glued in place.

to accommodate the control unit.

Because my control board did not need the full 6 mm thickness of the crutch to clear all of its components, I carefully cut a rectangular hole in the crutch. I then removed the piece but sliced off approximately $^{3}/_{32}$ inches of its thickness and glued that piece right back into the crutch, flush with its top surface. That made a neat pocket for the control board to be only visible from the bottom.

You can now cut out the $^{1}/_{32}$-inch plywood landing gear plate and bend the landing gear to the shape shown on the plans. It's easiest to bend the V-shape of the gear then the axles for the wheels (held on by a drop of Duco cement), and finally, the 45° bend approximately $^{1}/_{2}$ inch down from the apex of the V-bend.

Place the gear on the plate and trace around the outline of the wire. This will allow you to drill small holes along both sides of the wire to sew the gear to the plate using common thread. Instead of using a sewing needle, I simply spread a bead of CA adhesive over one end of the sewing thread. When it was cured, I clipped it to approximately 1 inch in length. That made for a nice "thread-needle" that could be pushed through the holes. After the gear wire is securely sewn in place, coat it with regular CA and let it cure.

In sequence, epoxy the landing gear plate to the bottom of the fuselage crutch, use hot glue to fasten the control board in its place, then glue the bottom fuselage to the bottom centerline after tapering the back end to a 2 mm thickness by sanding it to match the rudder thickness. After everything is cured and dry, you can add the top fuselage piece, again tapering the rear portion to fair smoothly into the rudder.

When the fuselage cruciform is complete, trial-fit the motor and gearbox into the slots in the foam, making sure to maintain the built-in down-thrust and right-thrust angles.

After you have confirmed the fit, hot glue the unit in place and hold it until it cools and cures. I found that it was easiest to set the hot-glue gun to its highest setting, squeeze out a puddle of glue, then use a toothpick to apply the glue to keep it out of the motor and gear mechanism.

Wing construction: With the fuselage essentially complete, the wing is next. For those who might not be familiar with the characteristics of thin Depron sheet, some basic information might be useful.

Depron has a grain that can be seen by holding it up to the light. The grain usually runs lengthwise on a stock rectangular sheet. The foam also has a shiny side and a dull side. For purposes of bending and molding, the shiny side should always be placed downward.

Because the Bitty Bomber's wing is undercambered, it will be necessary to create a curved surface to make it more amenable to following the curves of the wing ribs as they are glued in place. It will also be necessary to remove all rings from your fingers before you begin the process of setting the camber, to avoid denting the material on the top side!

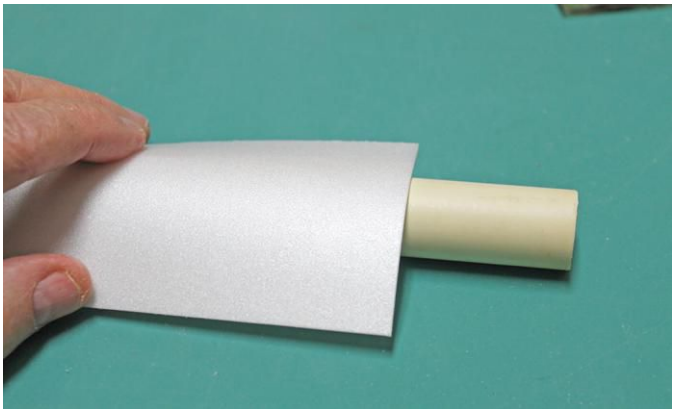
To get the required undercamber, a 12 x $^3/_4$-inch outside diameter piece of PVC pipe or a similar form can be used as a mandrel. All you need to do is place the foam blank, shiny side down, over the mandrel and roll the foam back and forth, using your palms and the flat of your hands for pressure against the mandrel. It won't take much to induce the required curved surface.

Curve the main center section and the two wingtips identically then glue the LE (leading edge) doublers to all three surfaces when you are satisfied with them. The two thinner dihedral ribs can be glued to the center panel roots, and the two 6 mm dihedral ribs can be glued to the wingtip roots with approximately 1 mm of each rib protruding to assist in the dihedral sanding process.

Take care that all three assemblies are constructed flat and square, with no twists built into them. Any twists or warps will give you the opportunity to cut some replacement pieces and try again!

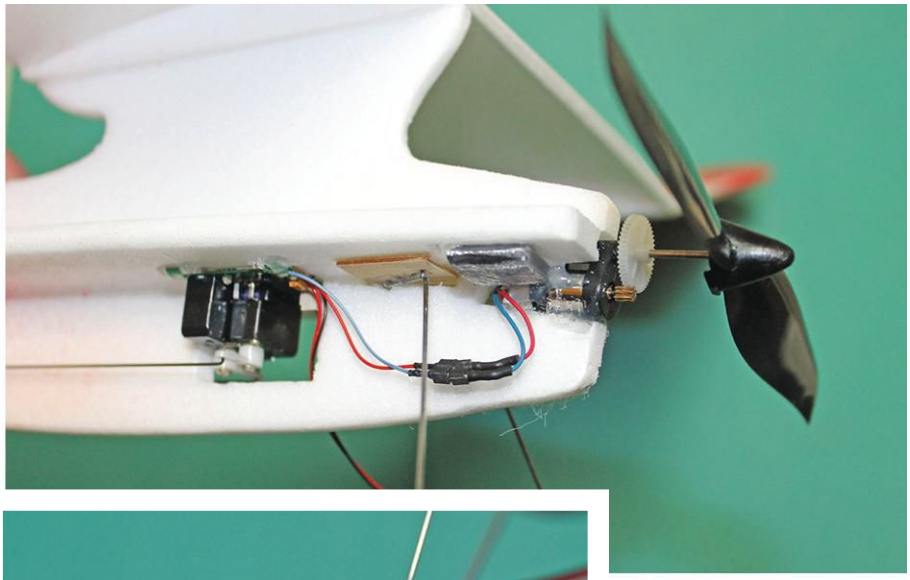
The 3-inch wingtip dihedral is accomplished by propping each respective wingtip up to its required height and sanding the 6 mm dihedral ribs to a 90° angle, much like a Hand-Launch Glider. Because there's not much material to work with, sand slowly and carefully, checking frequently for fit.

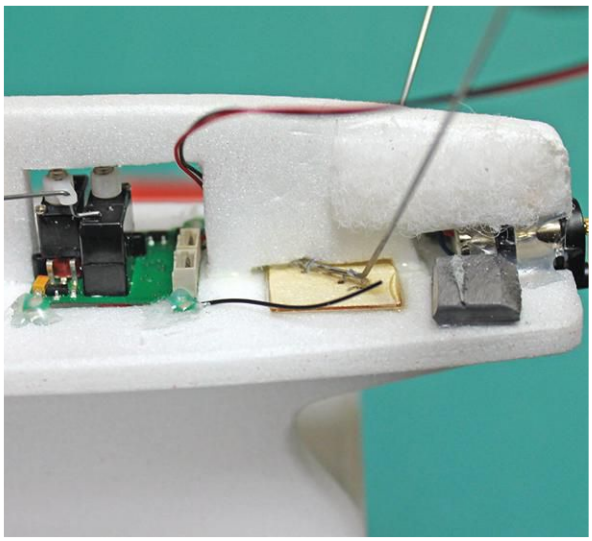
When both wingtips fit satisfactorily with no gaps in the dihedral joints, hold the center section flat with scraps of balsa pinned over the LE and trailing edge to the work board to clamp the piece down. Install each wingtip individually by propping it up to its required 3 inches. Glue it in place with foam-safe CA. Work slowly and carefully to avoid inducing any warps or uneven surface joints. When the unit is cured, sand the LE doublers to a rounded surface, tapering the wingtip doublers from full depth at the root to nothing at the tips.



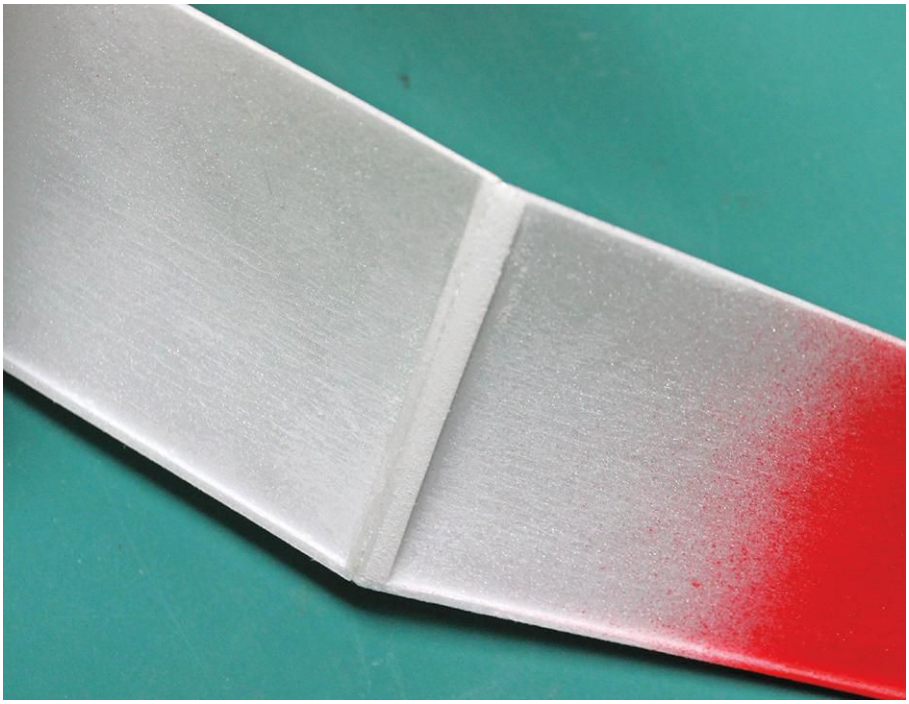
The wing panels require undercamber that is accomplished by rolling the bottom surfaces over a mandrel, such as this 3/4-inch section of PVC pipe. Specific instructions are in the text.

Tail surfaces: The stabilizer/elevator and the fin/rudder can individually be cut as one piece then separated at their hinge points. It will be necessary to join





These photos show how the control board, landing gear, and motor assembly were mounted. The 1/32-inch plywood gear plate was epoxied into position on the bottom of the fuselage crutch, while the control board and motor assembly were set in place using spots of hot glue applied with a toothpick. Note the required weights that were epoxied in a forward position ahead of the landing gear plate. The loop portion of the hook-and-loop battery mount is hot glued to the left bottom side of the fuselage.



The wing dihedral joint is comprised of a 1.5 mm to 2.0 mm rib mounted to the center section root rib, and a 6 mm rib mounted to each wingtip. The wingtips are then sanded to a shape that is similar to a Hand-Launch Glider wing to arrive at the correct angle for the 3-inch dihedral in each wingtip.

the elevator pieces at the rear with a small dowel then notch out the rudder to clear the dowel. I sanded a barbecue skewer to the required thickness and epoxied it in place. Both the elevator and the rudder should be sanded to a chisel shape at the hinge line to allow for adequate control surface movement.

One $^1/_2$-inch piece of Du-Bro Electric Flyer Hinge Tape was applied to the top of the stabilizer/elevator joint and the flat side of the fin/rudder and it worked well to hinge the surfaces.

Final assembly: Final assembly consisted of gluing the wing, elevator/stabilizer, and the rudder to the fuselage. Probably the easiest method is to first glue the tail sections to the fuselage crutch while constantly checking to see that they are at right angles to each other and not skewed in any direction.

The wing is next, and because I wanted to have a little bit of a fudge factor to ensure it was square with everything else, I marked the center of the main panel, used a smear of 5-minute epoxy over the top of the pylon, and put the wing in place. As it cured, I was able to make minute adjustments in its angle and position for a perfectly square fit in all dimensions.

After it cured (as one of the photos shows), I used two 6 mm ribs rounded on one side as the braces for the wing/pylon joint and placed them carefully in position, one at a time on each side, trying not to tilt the wing in the process. After one was dry, I installed the other.

If you want to add any color to your Bitty Bomber, this would be the time to do it. I used—and would recommend—Design Master Colortool Spray from Michaels craft stores (michaels.com). It is a fine spray that is easy to control in terms of the depth of color. It dries fast and is safe for all foam applications.

The Bitty Bomber has just one light spray coat on the wingtip panels, the aft part of the fuselage, and the tail surfaces. The weight penalty was just half a gram. The vinyl lettering was custom cut by my club mate, Dan Nicar, especially for the little airplane.

All that's left now is to hook up the control surfaces, but you will want to fire up your radio to find out which servo is attached to what control stick before you drill any control horn holes in the tail surfaces—particularly if you have the receiver board and servos mounted inverted. Having the transmitter's rudder stick attached to the elevator servo is not what you want to do. Don't ask me how I know.

It should be noted that practically all FF model aircraft from the late 1930s had short noses because the ignition batteries, motor, tank, and timer sat far forward to balance the airplane. The Bomber is no exception, so don't cringe when you have to add more weight than you think you should to the nose.

The Bitty Bomber required 9 grams of nose weight fastened to the underside of the fuselage crutch to balance at the indicated center of gravity, inclusive of the battery and the hook-and-loop battery strap. Without the flight battery, the airplane weighed an acceptable 37 grams, given its $25^1/_2$-inch projected wing area.

Flying the Bitty Bomber: Subscribing to the adage, "It's not an airplane until it flies," I waited for a fall morning with acceptable temperatures and a suitable amount of wind. When the airplane launched on its maiden flight at my local field, I flew it from the area where gliders are typically flown—out and away from the runway.

I needed to add just two clicks of down-trim after a straightaway hand launch. Two club mates who were flying powered aircraft from the runway area took it to be my big, electric Lanzo Bomber that I usually fly. They were amazed to see how small it was when it landed.

The best way to sum up its flying characteristics is to state that it flies like a bomber. It has a nice, gentle climb to altitude, requires slow, smooth turns to place it where you want it, and has a cruising flight that will easily last more than 7 minutes with some battery left.

Landing consists of chopping the power any time you are ready to land and watching the propeller gently turn over as it glides lightly down to land in front of you with a final flare. In all, the Bitty Bomber turned out to be a delightful spur-of-the-moment project that I hope you will enjoy as well. »

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Perfecting the slow roll

For pilots who aspire to add new maneuvers to their repertoires, I am a big advocate of learning to perfect a slow roll. On the surface, a long, slow roll is not a spectacular maneuver, but performing it from one end of the field to the other is difficult to do. It is also a solid foundation for many maneuvers.

A long, slow roll requires accurate and concurrent use of aileron, elevator, and rudder inputs. Multiple control inputs must be completed in precise amounts with precise timing to produce a slow roll with constant altitude and no changes in flight direction. Depictions of the aircraft attitude, along with transmitter stick positions every 90° of roll, are shown to help visualize the slow roll maneuver.

Looking closer at a slow roll to the right and flying from left to right along the flightline, the maneuver starts from level flight with a small amount of aileron (right for this example). As the airplane rolls 90° to knife-edge with the right wing low, left rudder is needed to keep the airplane level in knife-edge flight (Photo 1). The left rudder input is not binary; it is gradually input as the airplane rolls from level to knife-edge flight.

As the roll progresses to 45°, a small amount of up-elevator is added then reduced as the roll progresses from 45° to knife-edge. The amount of rudder and elevator needed, as well as the timing, will vary depending upon the airplane.

As the roll continues from 90° (knife-edge) to 180° (inverted; Photo 2), the left rudder input is gradually removed. A small amount of down-elevator is added to maintain inverted flight. From 180° to 270° (left wing low, knife-edge; Photo 3), the down-elevator is slowly reduced while right rudder is slowly added.

As the last 90° of roll back to level flight is completed, the right rudder is gradually removed, and a small amount of up-elevator is used.

How does the slow roll translate to other maneuvers? Fast rolls use the same inputs, just more aileron and faster sequencing of the control inputs. Point rolls (or hesitation rolls) are, in essence, a slow roll with hesitations at every 90° (four-point roll) or every 45° (eight-point roll). Rolling harriers use the same inputs as a slow roll, but the amount of the inputs is increased greatly to keep the nose of the airplane higher, generating enough lift to keep the airplane from sinking at low speed.

How about a rolling circle? Consider the slow roll example. If the initial left rudder input is made too early, the nose of the aircraft will turn left and away from the flightline. If the down-elevator input is made early, the nose will turn farther from the flightline. If the right rudder is applied early, the flight path of the airplane will continue to follow a circle. As the roll is being completed, applying up-elevator early will again direct the flightpath in a circle.

In the previously described rolling circle instance, it is characterized as an "out"-rolling circle because the roll direction is toward the outside of the circle. An "in"-rolling circle can also be completed. With an in-rolling circle, the rudder and elevator inputs are completed relatively late, resulting in the flight path turning in versus turning out (early inputs).

The number of rolls per

Photo 1: The slow roll maneuver is captured after the first 90° of roll. At this point, the control inputs are a small amount of right aileron (constant throughout the maneuver) and a little left rudder (blended from approximately 45° to 135° of roll).

360° circle can be controlled by the amount of the rudder and elevator inputs that are relative to the roll rate. Slower roll rates with relatively larger rudder and elevator inputs will produce a circle with fewer rolls.

Another maneuver utilizing similar inputs is a rolling loop. The rolling loop is just a rolling circle completed in the vertical plane instead of the horizontal plane. In essence, the rolling circle inputs are completed slightly earlier, held longer, and are slightly greater. The result is that the nose of the airplane is steered into a climb, as opposed to away from the flightline.

To start the rolling loop, a small amount of up-elevator is added at the start of the roll to point the nose up. The initial left rudder input is exaggerated to further point the nose up. The amount of down-elevator is then increased, and the already climbing airplane will increase the climb angle. When the aircraft has completed 90° of loop and is essentially in a vertical climb, continuing the sequence of control inputs (timing and amounts) will direct the airplane back toward the direction it came from to complete half of a loop. Continuing the control inputs even more will eventually result in the completion of a rolling loop.

Another consideration for the rolling loop versus the rolling circle is gravity. On the first and last quarter of the loop (bottom half), the airplane is working against gravity. On the second and third quarters of the loop (top half), gravity pulls the airplane back toward the ground. This means that the control inputs on the top half of the loop are relatively smaller than the inputs of the bottom half.

It should go without saying that increased throttle is used on the climbing portion of the loop, and low throttle (perhaps even idle) is used on the diving portion of the loop.

The described maneuvers are not easy to learn, but understanding the relationship between the maneuvers makes it easier to translate existing skills to new maneuvers. A well-designed, assembled, and well-set up aerobatic aircraft makes the challenge of learning the maneuvers easier.

To illustrate the desired aircraft attitude and transmitter stick positions, the screen captures shown are from the RealFlight simulator (realflight.com). The aircraft used is an F3P Expedition flown by Joseph Szczur, who competed on the US F3P World Championship team (teamusaf3p.com). The flight speed was intentionally slowed to show exaggerated aircraft attitude, control surface deflections, and stick positions. »

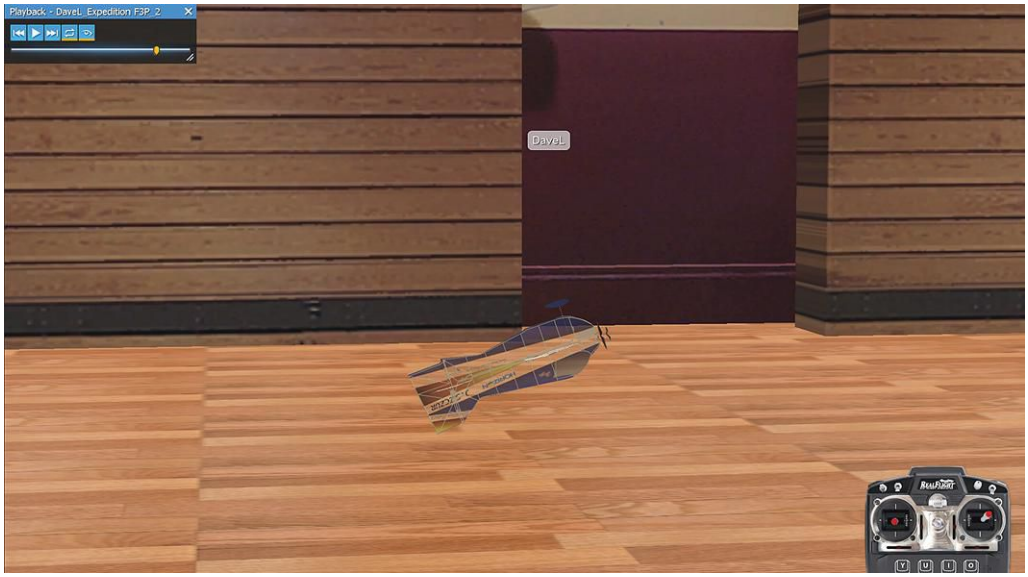

Photo 2: At 180° of roll, the small amount of right aileron remains, rudder is neutral, and a little down-elevator is used (blended from approximately 135° to 225° of roll).

Photo 3: At 270° of roll, the small amount of right aileron remains and right rudder is used (blended from approximately 225° to 315° of roll).

DJI Mavic Mini Fly More Combo

FAA registration not required

Photos by Jon Barnes

Although its sub-250-gram all-up weight makes it a bit more vulnerable on windier days, the Mavic Mini generates the same incredible, super-stable in-flight video as do the various full-size members of the DJI family of Mavic drones.

The DJI Mavic Mini is the latest product to be released by one of the industry's most prolific designers and manufacturers of aerial media-capable drones. The significance of this release is perhaps ultimately measured by the fact that the Mavic Mini is specified as having an official takeoff weight of 249 grams. Although this fact (currently) mitigates the need for pilots to register to fly the Mavic Mini with the FAA, it does not in any way, shape, or form eliminate the need for all pilots to be informed and to fly responsibly at all times.

The Mavic Mini can be purchased alone ($399) or as part of the Fly More Combo package. The first option gives pilots a Mavic Mini, one flight battery, the remote controller, spare propellers, and a three-pack of cables to allow it to be connected to any officially supported Android or iOS device.

The Fly More Combo adds two more flight batteries (for a total of three), an efficient two-way charging hub, a set of propeller guards, and a compact carrying case that conveniently holds everything but the propeller guards. Although the second option will set a pilot back an additional $100, the cost of purchasing the parts separately (each flight battery is $45, the charging hub is $39, the propeller guards are $19) makes the Fly More Combo an easily justifiable expense for those who plan to go all in with their Mavic Minis.

Fliers who like to show off their drones might get a kick out of the optional clear, dome-shaped Mavic Mini charging base. It allows the wee Mavic to be kept on a table and displayed as a pseudo art form instead of being secreted away in the box or case when not being flown.

Before their first flights, modelers will need to download and install the DJI Fly app on their mobile devices. A number of other DJI-authored apps might also appear when searching for the DJI Fly app. These include DJI GO and DJI GO 4. The Fly app was developed by DJI specifically for the Mavic Mini.

SPECIFICATIONS:

TYPE: Multirotor aerial media aircraft
SKILL LEVEL: Beginner
FOLDED DIMENSIONS: 5.5 x 3.2 x 2.3 inches
UNFOLDED DIMENSIONS: 6.3 x 8 x 2.2 inches
WEIGHT: 8.78 ounces
FLIGHT DURATION: Up to 30 minutes
PRICE: $499
INFO: dji.com

FEATURES:

- Three-axis gimbal
- Up to 30-minute flight duration on one flight battery
- 1/2.3-inch CMOS 12-megapixel sensor
- Video resolution is 2.7K at 25/30 pixels; full high definition at 25/30/50/60 pixels (MP4 Codec)
- Photos: 4,000 x 3,000 JPEG (4:3); 4,000 x 2,250 JPEG (16:9)
- Propeller guards make for safer indoor flying
- Four built-in, preprogrammed QuickShots (Dronie, Rocket, Circle, Helix) make for easier "canned" video shots
- Charging hub sequentially charges up to three batteries
- Video editor is included in the DJI Fly app

The Mavic Mini must be "activated" from within the app before it can be flown. If pilots have owned and flown

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DJI packs nearly 90 minutes of aerial media capabilities—including the hardware required to recharge the flight batteries and flight controller—into a convenient package that is roughly the same size as a man's shaving travel kit. The only items that do not handily fit into the carrying case that is included with the Fly More Combo are the two large propeller guards.

other DJI products, this is as simple as providing your existing DJI credentials when prompted.

For pilots new to DJI products, a user account will need to be created. A series of short, beginner tutorial videos can be accessed from the home page (a small open book icon in the upper right corner) and are invaluable for helping fliers quickly become familiar with the full set of features on their new Mavic Minis.

Park Pilot Program members will likely be prompted to upgrade the firmware in their Mavic Minis to the latest version upon initial power up. A tutorial video is also included to help successfully accomplish this important task. Six Mavic Mini PDF format documentation files are also included in this part of the Fly app.

Flying: It is imperative that aeromodelers perform three important tasks before sending their Mavic Minis aloft for the first time.

They should first perform an inertial measurement unit and compass calibration. The app clearly walks a user through the two processes. Best practice suggests that the latter calibration be performed whenever a pilot flies his or her Mavic Mini at a location that is significantly distant from the location at which it was last flown.

The final—and potentially drone-preserving—preflight task is to adjust the RTH (return to home) elevation. This is the minimum altitude that the Mavic Mini will ascend to before executing any RTH commands. This elevation needs to be set higher than the highest structure(s) in the area where the drone is being flown. If this parameter isn't properly set, the Mavic Mini runs the risk of blindly flying into the side of a building or hitting a tree.

Unlike some of DJI's previously released drones, the Mavic Mini is not equipped with sensors or intelligence to avoid flying into objects. Any RTH commands will result in the Mavic first ascending to the set RTH altitude (if currently below that altitude) and then flying a straight-line path back to the original point of takeoff.

Flying the Mavic Mini is a confidence-inspiring experience. Even if a modeler has never flown a drone, his or her chances at success are almost a solid 100%. Pilots might want to start out in the CineSmooth mode for their initial flights. This severely limits the maximum speed and somewhat dampens the braking response of the Mavic, although as the mode name implies, it is done to create the smoothest possible in-flight video.

Release both control sticks at any time and the Mavic Mini will hover in place until commanded otherwise. In Sport mode, the Mavic Mini can achieve speeds of up to nearly 30 mph. Given its relatively diminutive size, the Mavic Mini looks impressively fast when zipping around the sky at that speed. Thanks to DJI's advanced three-axis camera gimbal, even the video shot in this more agile mode is still unbelievably fluid and always rock-solid.

Pilots interested in shooting aerial photographs will likely be quite impressed with the clarity of the JPEG images. Although the camera sensor is a smallish, 1/2.3-inch CMOS (complementary metal-oxide semiconductor) 12-megapixel sensor, this longtime digital photographer feels that the photos generated by the Mavic Mini rival those shot by cameras equipped with larger/higher-resolution sensors. A small selection of preprogrammed Quick Shots makes it easy to select a subject and then execute professionally smooth video shots.

My favorite Quick Shot is the Helix. In this shot, the Mavic Mini will fly in a spiral of increasing diameter, upward and away from the designated subject. Pilots can define the distance that the drone will fly outward away from the subject until it stops. After the shot has been completed, the Mavic Mini faithfully returns to the initial starting point and awaits its next order. Potential flight durations of nearly 30 minutes allow fliers to accomplish an amazing amount of in-flight adventure and/or aerial media per battery.

Pilots who purchase the Mavic Mini will likely do so to gather aerial media. Although the video files can be shared in their raw, unedited state, the DJI Fly app includes a surprisingly powerful video editor. Those who are accustomed to editing their videos on a laptop or desktop PC might still prefer the larger display real estate, more powerful processors, and fuller-featured video editing applications that are offered by these legacy platforms, but the embedded video editor offers a quick and easy way to chop through an assortment of clips and assemble them into a meaningful video.

The editor offers both template-based and "Pro" modes. The former includes 26 uniquely different templates with catchy soundtracks. The latter

The three-battery charger has the smarts to sequentially charge up to three flight batteries, although charging three fully depleted packs will take some time. It does double duty as a storage case for batteries and, thanks to its included Type A USB port, can also be used as a portable power pack with which to recharge other portable electronics.

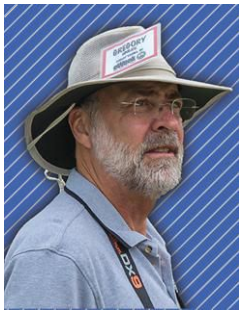
mode allows modelers to go even deeper under the hood and tweak the tone (brightness, contrast, sharpness, saturation, temperature, vignette), perform rudimentary color grading, add titles, adjust the speed of playback, and so on. Twenty-eight audio soundtracks are provided, as well as the option to import audio via AirDrop, WeChat, and iTunes.

Pilots who are content to edit their videos on their handheld devices will not need to shell out any additional money for a standalone video editing app, but the included video editor will require them to navigate a learning curve in order to become proficient.

Conclusion: Although there is a seemingly inexhaustible inventory of inexpensive aerial media-capable drones that fliers can purchase and play around with, the DJI Mavic Mini possesses a pedigree that draws heavily upon the well-developed and proven features that are inherent to legacy DJI aircraft such as the Phantom, Inspire, Spark, and Mavic.

Thanks to the DJI Mavic Mini Fly More Combo, those who are serious about their aerial media and have yet to taste the exquisite engineering that is native to DJI's drones can now do so at the unheard of price point of roughly $500! The only item not included in the box is a microSD card! »

For an additional $100, the Fly More Combo, when compared with the cost of purchasing the Mavic Mini and flight controller alone, makes it the obvious choice for pilots who want to spend more time flying and less time waiting for batteries to recharge.



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The best place to start—baby steps!

In my last column, I discussed something advanced—the mechanics of autorotation—but I wanted my readers to understand why helicopters don't just fall from the sky if a motor quits. This time, I will go all the way to the beginning because flying season is upon us, and you'll likely be out knocking the rust off of your skills or learning for the first time.

Instructors: With any luck, you'll have an instructor to help, but it's often the case that we end up teaching ourselves unless there are other helicopter pilots around who are willing to help. Look for an instructor who is open to trying different methods to help you learn.

Finding what works for you is important. Don't let the instructor rush you, and make sure you find one who doesn't think you're in a military training environment. This is your hobby; enjoy the process.

So, you're on your own. You've got lots of company. Many of us taught ourselves to fly helicopters. Fortunately, there is a wealth of online resources with learning in mind that can guide you and inform you of your helicopter options.

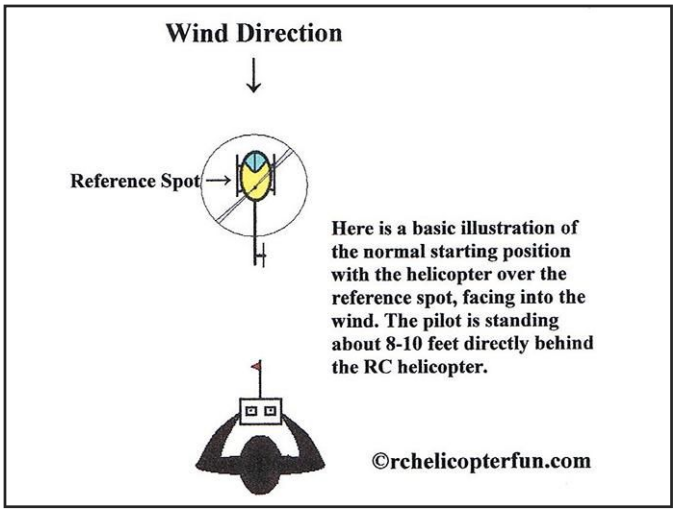
I suggest that you check out John Salt's RC Helicopter Fun website (rchelicopterfun.com). He has a multipart training course that is custom made to help you learn. He was kind enough to provide the diagrams for this column.

The big secret: Go slow and be methodical! That's it—no, really! This is the biggest mistake that newcomers make. They get in a hurry and try things before they're ready.

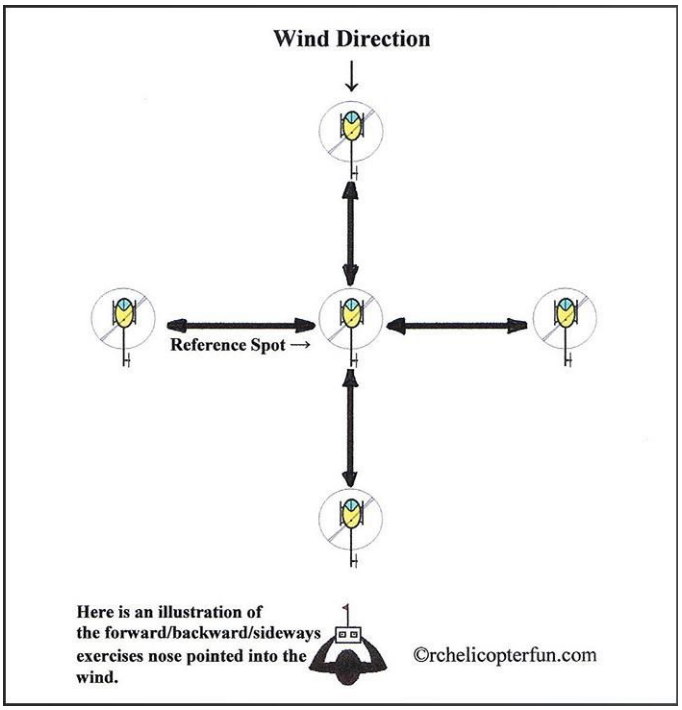
You might also try to do flying sessions that are too long. When you begin to feel overwhelmed and as though you are getting into trouble, it's time to stop for a spell. Have a plan; don't just go out and decide it's time to hover. Read over John's plan and adapt it to fit you.

Basics:

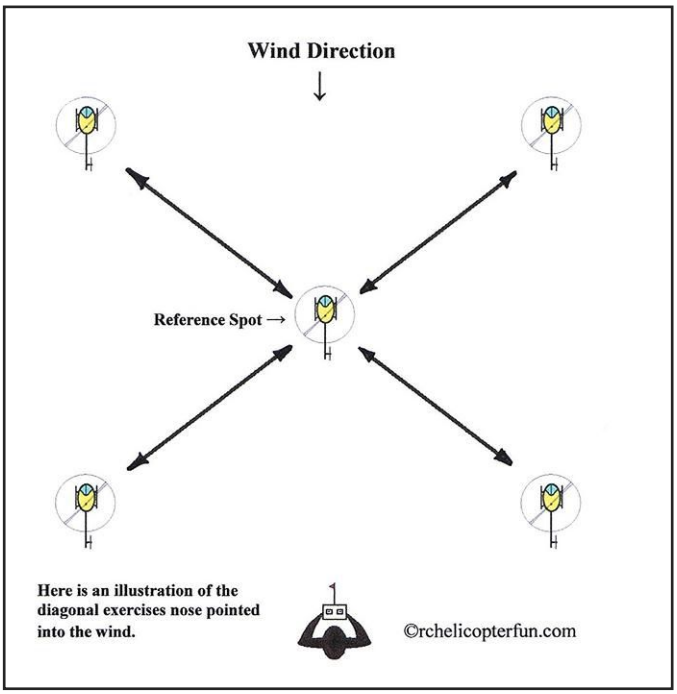
- Choose a beginner helicopter.
- Pick a calm day.
- Always face into the wind with the nose of the helicopter pointing away from you.
- Stand several feet behind the helicopter and focus on the nose, not the tail.
- If things begin to get out of control, land the helicopter. Don't try to move to forward flight and recover. You have to hover at some point, so forward flight just exacerbates the problem.
- If the helicopter begins to point toward you, immediately use the tail rotor to rotate the heli back to the start position and land. Regroup and try again.



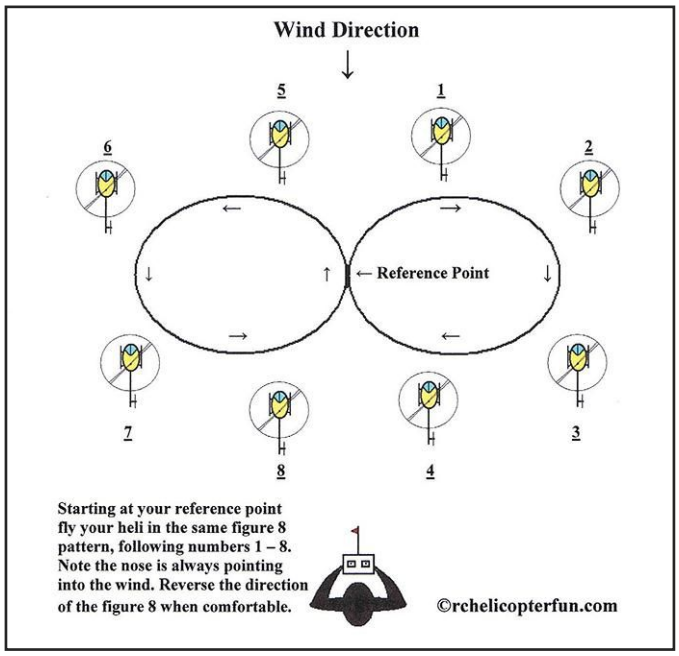
The basic starting position for hover training.



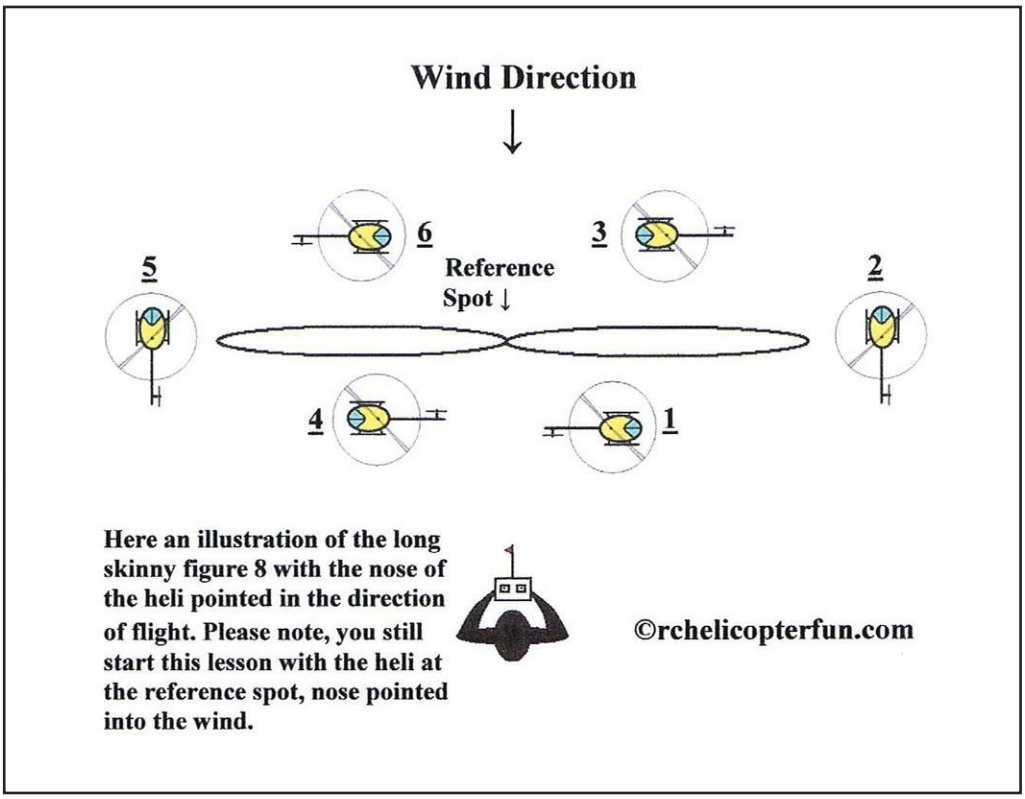
When you're comfortable hovering, begin fore, aft, and lateral movement training.



Shown is slightly more-advanced, diagonal-path movement training.



This is the next big step in moving the heli to where you want it. Maintain altitude and follow a path, but always keep the nose pointed away from you.



This flattened Figure Eight will begin to orient you with forward flight. All of the turns are away from you. Do not allow the helicopter to speed up. If it does, stop and stabilize it before continuing.

- Perfect stationary hovering a few feet above the ground over a spot before you try to do circles or Figure Eights.
- Don't panic!

Training plan: Work on becoming comfortable in a stationary hover before you try anything else. Take your time; this is the hardest step. After you find your "hover button," you will progress quickly. That's the term used in the Army when we were suddenly, magically, able to hover—it just seemed to happen. After you've accomplished that, begin to work through some of the maneuvers that are described in the diagrams.

When you are beginning to move the helicopter around, do so cautiously and don't rush. These plans will always have you turning away from yourself so that you don't encounter control reversal with nose-in flight. If you begin to get into trouble, just rotate the heli so that its nose is away from you again, and land or stabilize it in a hover until you're ready to continue.

Wrapping up: Writing a complete training program would fill a book, so check out the RC Helicopter Fun website that I referenced and study these diagrams. Going slowly at the beginning will reduce frustration and might even save you some money. »

Spektrum Smart Technology

Know more about your batteries

When thinking about what is classified as a "smart" device, a modern cellphone likely is what comes to mind for most people. However, TVs, microwaves, refrigerators, and other devices that can connect to the internet or other networks are also given that designation. Some feel that being connected doesn't necessarily mean a device is "smart," but it must also provide some type of useable benefit.

As someone who has adopted smart products at home including speakers, smoke detectors, and a thermostat, I was excited and eager to learn more about the Spektrum Smart technology that would allow me to access more information about my batteries and the devices to which they are connected.

LiPo batteries with Spektrum Smart technology have an installed microchip on every battery that feeds information through a data cable to the new IC3 and IC5 connectors. These batteries store unique data such as chemistry type, cycle count, charge rate, error log, and more.

Most intriguing to me was the Smart Discharge feature on the batteries. LiPo batteries will perform better if they are kept at a storage charge when not in use. Leaving LiPos fully charged for an extended period of time will increase resistance and reduce capacity.

When programmed with a Spektrum Smart charger, Smart batteries will automatically discharge to your predetermined storage voltage when they are left to rest for a time period that you choose, between 12 and 240 hours. Although it is a low discharge current of approximately 150 mAh, this unique feature results in longer battery life expectancy and better performance throughout the life of the pack.

Another simple, but exciting feature of the Smart batteries is that the orange IC3/IC5 connectors are much easier to unplug than

Spektrum Smart technology gives us access to a wealth of data when using Spektrum Smart batteries, such as chemistry type, cycle count, charge rate, error log, and more. Programming options allow you to custom tailor the Smart LiPo battery to your needs.

Photos by Jay Smith

the older blue EC3/EC5 connectors. In my testing, my thumbs and index fingers have been much happier with connecting—and especially disconnecting—the new batteries.

S1500 DC SMART CHARGER

SPECIFICATIONS:

BATTERY BALANCE CONNECTOR: JST-XH
BATTERY TEMPERATURE MONITORING: Yes (temperature sensor included)
BATTERY TYPE: 1S to 6S LiPo, LiFe, LiHv; 1C to 16C NiMH, NiCd, Pb
CIRCUIT BREAKER: Yes
COOLING METHOD: Fan
DISPLAY: 2.4-inch 320 x 320 IPS LCD
HEIGHT: 1.9 inch
INPUT VOLTAGE: 8 to 30 volts
INTEGRATED BALANCING: Yes (internal balancer and external adapter)
LENGTH: 3.7 inches
LOW INPUT VOLTAGE PROTECTION: Yes
MATERIAL: Plastic case
MAXIMUM CHARGE RATE: 26.1 volts, 20 amps
MODEL MEMORY: Smart ID
OUTPUT CONNECTOR: IC3 (compatible with EC3)
OVER-CURRENT PROTECTION: Yes
PC CONNECTIVITY: Yes (USB, external adapter required)
PC REQUIRED: No
PEAK DETECTION: Yes
REVERSE POLARITY PROTECTION: Yes
SAFETY TIMER: Yes
SELECTABLE CHARGE RATE: Yes (incremental [0.1-amp increments])
SHORT CIRCUIT PROTECTION: Yes
SOFTWARE UPDATES: Yes (via USB port)
THERMAL PROTECTION: Yes
TYPE: DC-powered Smart battery charger
WEIGHT: 8.5 ounces
WIDTH: 3.8 inches
PRICE: $119.99
INFO: horizonhobby.com

The Spektrum S1500 charger takes up a small footprint but provides a lot of information about the connected battery, especially if it is a Spektrum Smart battery.

S1500 Smart Charger: I selected this because it was the most powerful charger at 500 watts and I wanted the ability to charge my 6S 5,000 mAh batteries at 1C or above. It is important to point out that although the charger is marketed to quickly charge large, high-capacity, high-cell-count batteries, an adapter to connect batteries with IC5 or EC5 connectors is not included and needs to be purchased separately (adapter: IC3 Battery/IC5 Device SPMXCA507).

Included in the box you will find the Spektrum S1500 DC Smart Charger, an IC3/banana power supply cable, and a product manual. This is a DC-only charger that allows it to provide a higher wattage, so to use the charger you will also need a power supply.

This capable charger takes up a small footprint and incorporates the balance and battery connections directly on the side of the unit; no banana plugs or balance boards are used.

Navigating the charger is done using the scroll wheel, which is similar to an iPod for those who are familiar. It works reasonably well but is not as smooth as an iPod. Slide your finger clockwise around the touch menu scroll wheel to scroll down a menu list. Slide your finger counterclockwise to scroll up a menu list. Press and release the menu button to select a menu item. While on the home screen, a short press of the menu button enters the task settings and a long press enters the system settings.

When connecting a battery, the options are Charge, Discharge, and Storage. Based upon the information provided by the battery, either from the balance port or the Spektrum Smart technology, the charger will set the basic parameters for the battery that is connected. The user can easily edit or change those settings. As an example, when charging my 6S 5,000 mAh LiPo battery, I set the charge rate at 1C.

The System Settings menu provides the ability to tailor some options such as Backlight (automatic, low, medium, or high), Volume (off, low, middle, or high), Touch Sensitivity (set as low or high), and Completion Tone (select single tone or repeating). You also have the ability to select a language.

I have used the S1500 charger with a few different batteries, including those made by other manufacturers, without issue. The charger was even able to balance a 6S pack that had three cells lower than the rest because I had used a lightning system. This was after another charger was unable to bring all of the cells into balance.

The S1500 charger packs several useful features, including a USB port, software update port, safety timer, and protection against heat, reverse polarity, short circuit, over-current, and low input voltage. When combined with a Spektrum Smart battery, this charger really shines by providing much more data than is typically available with a conventional charger.

Spektrum Smart 30-amp power supply: The SPMXC10201 connects to a 100- to 240-volt AC outlet and provides consistent DC power at 12 to 18 volts for chargers and other applications at up to 30 amps continuous (up to 540 watts).

The power supply has two main output ports with the ability to power dual DC chargers. It also incorporates two 5-volt USB ports. A dial on the front controls the adjustable power output from 12 to 18 volts. The LCD display clearly indicates output voltage and current, making adjustment precise.

I appreciate that the power supply incorporates a power plug, and the all-metal design promotes rapid cooling, with the fan only needing to run occasionally. For safety, the power supply features protection against overheating, overloading, and short circuits.

The Smart 30A Power Supply pairs nicely with the Spektrum Smart Charger and I will likely be adding a second Smart charger when flying season begins.

SMART 30-AMP 540-WATT POWER SUPPLY

SPECIFICATIONS:

Type-switching DC power supply

INPUT VOLTAGE AC: 100 to 240 volt

INPUT AC FREQUENCY: 50 to 60 Hz

INPUT FUSE: 10 amps

OUTPUT VOLTAGE: 12 to 18 volts DC +/- 0.5 volts

USB SUPPLY: (Two) 5 volt (1 amp total)

MAXIMUM CURRENT: 30 amps at 540 watts (total)

Output display voltage and current

OVERLOAD PROTECTION: ≤ 31 amps, 500 MS

OUTPUT VOLTAGE RIPPLE: < 150 megavolts

POWER EFFICIENCY: 89%

OVER-TEMPERATURE PROTECTION: <65˚ C (0-104˚ F)

COOLING: Two automatic fans

OUTPUT CONNECTORS: (Two pair) bullet/banana plug sockets

WEIGHT: 3.57 pounds

PRICE: $109.99

A dial on the front controls the adjustable power output from 12 to 18 volts. The LCD display clearly indicates output voltage and current, making adjustment precise.

SPEKTRUM XBC100 SMART BATTERY CHECKER AND SERVO DRIVER

SPECIFICATIONS:

BATTERY BALANCE CONNECTOR: Included for testing LiPo batteries

BATTERY TEMPERATURE MONITORING: Yes

BATTERY TYPE: 1S to 8S lithium; 1- to 10-cell NiCd/NiMH

CELLS

BALANCING CELL ACCURACY: <0.005 volts

CONNECTOR TYPE: IC3

LCD: Yes

SERVOS: Also tests servos without having to connect a radio and receiver

VOLTAGE: +/-0.005 volts at 4.2-volts measurement accuracy

VOLTAGE RANGE: 5 to 36 volts

PRICE: $39.99

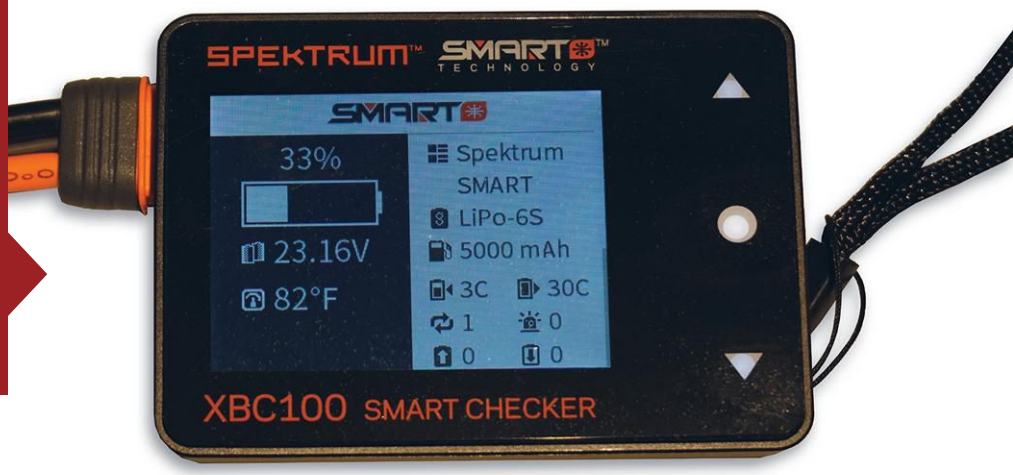
XBC100 Smart Battery Checker: It works much like other battery checkers when using non-Smart batteries. Connecting a Smart battery really unlocks its potential by providing a simple-to-use battery checker that provides all of the integrated parameters such as the number of cycles, and events such as over-discharge and overheating. It also adjusts Smart battery settings such as auto-storage timer and preset charge current.

After unboxing the cell checker and installing the included screen protector and lanyard, I read the included manual. I was curious about the proper way to connect the balance plug on a non-Smart battery to the checker and observe proper polarity. To my surprise, no illustration or information is provided beyond the use of the balance connector when connecting a conventional LiPo battery to the XBC100. Connecting the main (non-Smart battery) connector to the battery checker will display the full pack voltage.

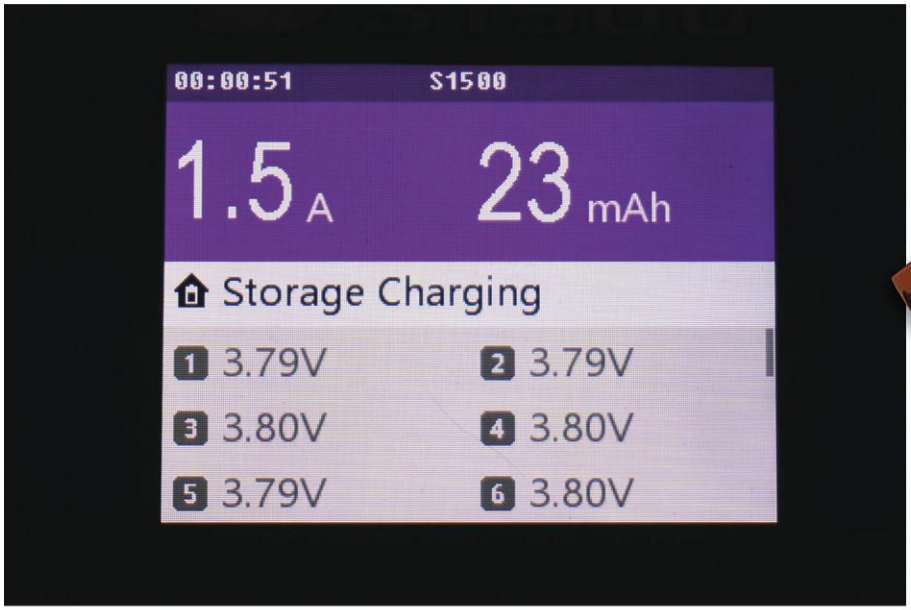
When plugging in the balance plug on the left side of the cell checker, you will want the red wire facing down. The balance plug should be connected at the top of the balance port closest to the IC3 connector. My first attempt had the plug inserted the correct way, but I connected it to the bottom part of the balance port on the checker. Fortunately, there was no ill effect other than the checker not working properly until I moved my connection to the top of the port.

When connecting a Spektrum Smart battery, you will use the IC3 main battery connector. If you are using larger cell-count batteries that have the IC5 connector, you will need to purchase an adapter to connect the battery (adapter: IC3 battery/IC5 device SPMXCA507).

Press and hold the menu button when connecting a Smart battery to the battery checker to enter the system settings for the battery. Smart battery menu options include Auto Storage, which defines how long the battery waits before initiating the auto-storage function. Storage Voltage



The Smart Checker provides information about the number of cycles, events such as overdischarging and overheating, and Smart battery settings such as auto-storage timer and preset charge current.



When charging, discharging, or using the storage mode, you can always see individual cell voltages on the main screen.

Spektrum Smart chargers and the cell checker are compatible with the blue EC3 connectors that are found on older E-flite batteries.

defines the storage voltage that the battery will set for auto storage. Charge Voltage defines the maximum allowable voltage. Exception Record allows you to check the record of overcharging, overdischarging, and overheating. Back exits the menu.

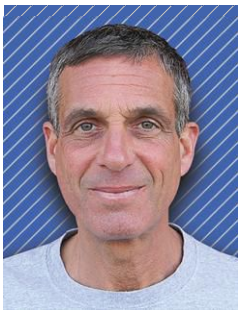
Integrated Servo Tester: A handy feature built into the XBC100 Smart Battery Checker is a helpful PWM outport that is facilitated to be used as a servo tester. This allows you to check control ranges on any modern servo or ESC. Users can test for binding and current draw right from the checker; no special inline meter is required.

After you have connected your servo, simply select Auto CW/CCW. This option is used to cycle the servo, which sweeps back and forth through the full servo travel. As it goes through the full range of motion, watch the LED screen to monitor the current. You can also manually adjust the servo's output if you desire.

LiPo batteries with Spektrum Smart technology have an installed microchip that feeds information through a data cable to the new IC3 and IC5 connectors.

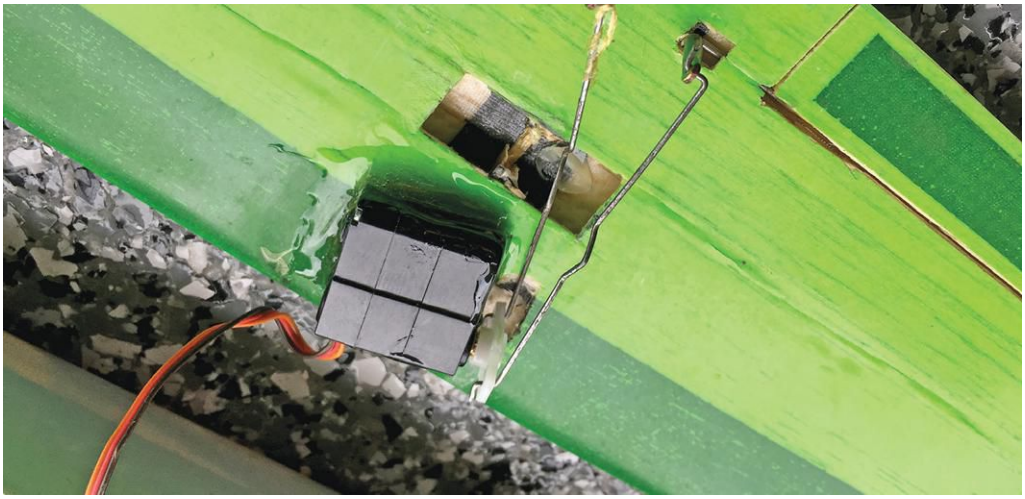
Qualcomm 3.0 USB Charge Port: Although this feature is unlikely to be used often in a home setting, it can be quite helpful when you are at the field without easy access to electricity. Just plug in a charged battery and hit Start USB Charging and the XBC100 becomes a fast-charging power bank ready to keep your Spektrum Smart transmitter and mobile devices charged. It supports Qualcomm QC 2.0/3.0 and is compatible with BC1.2 and Apple devices. The maximum output is 12 volts/2 amps.

The Spektrum XBC100 Smart Battery Checker and Servo Driver packs a lot of useful features into this small device. Similar to all of the Spektrum Smart products, the checker provides a lot of functionality, but connecting a Smart battery is when it really shines. »



Don Belfort
dbelfort@cinci.rr.com

Preflighting for heat effects



Heat can have a negative effect on our model aircraft. Make sure to perform a complete preflight check. If a crash occurs, look everything over before the next flight.

Hi park pilots. The environment in which your models are stored or transported can have detrimental effects that are not always noticeable during a preflight check.

In summer 2019, during four very hot days, I attended flying events in two states. The Stinger, an aircraft that I used to practice for the AMA Nats (modelaircraft.org/nats) Electric Formula 1 RC Pylon race at the International Aeromodeling Center in Muncie, Indiana, had been flying fine flight after flight without issues, but it had been subjected to high heat at the field and in my car.

Arriving early at the Nats, I took a practice flight. I flew the airplane around the course for a few laps and set up to land, when it rolled into the ground like I had never seen it roll. Luckily, there had been a lot of rain. Because of the wet ground, only the propeller was damaged.

My aileron servo had come unglued, causing the crash. The servo had been glued in for 10 years. Would a closer inspection of the wing before the airplane was armed have caught the problem? How many models have servos attached with hot glue? I assume that they could be subject to problems with high heat as well. There is more to checking the controls before takeoff than only checking for the proper control direction.

The problems with my practice RC Pylon Racing aircraft were just beginning. I repaired and reinforced the aileron servo mount, tested it at home for fit and operation, and looked for cracks in the airframe. The following week, I was at my club field test-flying the Stinger. Everything was fine—not even a trim change was needed—when I suddenly had no elevator control. I cut the power, and the wet conditions and soft soil again protected the Stinger.

I picked up the airplane and heard nothing when I moved the elevator. Had the servo gone bad? Removing the wing revealed that the elevator servo plug was in the receiver, but one of the wires had ripped away—most likely from the previous crash. I did remember repositioning the receiver after the first crash, which is when I should have caught the failing wire.

I share these experiences in hopes of preventing them from happening to you. Both of the crashes came without warning, causing my airplane to be out of control. Always keep your models flying in safe airspace away from others, just in case.

The winter months signal the building season for me, and that means I need to have quality glue and balsa on hand. bSi (Bob Smith Industries; bsi-inc.com) has produced high-quality adhesives for modeling needs for years, with new products always on the horizon.

I have commented on how useful bSi Un-Cure CA Debonder is for removing drops of CA adhesive from your film finish, but I never realized that it will also remove CA from balsa, saving a lot of finishing time.

National Balsa (nationalbalsa.com) sells high-quality balsa, plywood, and laser-cut kits. Its employees also attend many fly-ins and show off the company's products, allowing you to hand-select wood for your next project.

The Earl Stahl-designed, rubber-powered Fairchild PT-19 in its original 23-inch form is a perfect airframe for a Horizon Hobby E-flite two-cell brushless brick system (horizonhobby.com) that has been taken from a swap meet purchase or a retired ARF airframe. The plans are easy to read with few pieces to cut, and the hinge lines that you will create are already drawn.

I built a PT-19 directly from the Stahl plans to try to

bSi Un-Cure CA Debonder can get you out of a jam. Hitec RCD HS-7245MH servos with Sullivan Products 2-56 Aluminum Ball Connectors and All Thread Rods create a smooth, easy way to adjust linkage. The PT-19 is shown with its external servo and strip ailerons.

get away with three-channel control, but it did not work out. I then added strip ailerons with an externally mounted servo, which would allow the PT-19 to have good control with non-scale ailerons and would be easier than going with scalelike, barn door-type ailerons.

I used discrete components that added to the weight instead of using the E-flite brick, but it is still a great flyer for small outdoor areas and is capable of basic acrobatics and beautiful touch-and-gos. The cost to build the PT-19 will be minimal if you have a "donor" radio and power equipment. No hatch is required because battery access is through the front of the cockpit.

Delighted with the rubber-powered plans/electric-powered version, I enlarged the plans for another build. The PT-19 has five tip surfaces that can be constructed with laminations of balsa and plywood glued together with wood glue. Start with an easy-to-cut foamboard pattern then cut your laminating stock slightly oversize and determine the number of laminations that are needed.

Lastly, as accurately as possible, cut a strip of $^1/_{64}$ plywood that is the exact size of your lamination. Spray the balsa and plywood with Windex on both sides, wipe off the excess, then apply wood glue to one side of each piece. Start with the $^1/_{64}$ plywood and layer on additional balsa as needed.

With the $^1/_{64}$ plywood strip against the pattern, work the balsa and plywood around the pattern. Wipe your hands and tear off 10 to 15 10-inch lengths of masking tape, which will be taped over the balsa and plywood, around the pattern as needed. If it all looks good and straight, place it aside and allow it to dry overnight then remove the tape, sand it to shape, and remove it from the pattern. I really enjoy making laminated parts. It might be fun to try making a rudder or wingtip to see how easy it is.

When your framework is complete, install your equipment. I find that the linkage hardware options that are available from Sullivan Products (sullivanproducts.com) are second to none. Although it would not work in a micro PT-19, the Sullivan 2-56 Aluminum Ball Connector with Locking Sleeve is a great flight-control enhancement. It allows for easy fine-tuning of aircraft that are equipped with gyro controls that specify mechanical adjustment for transmitter trim.

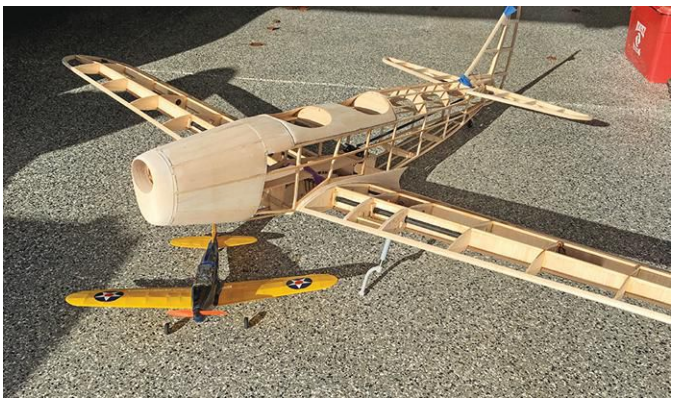
The aluminum ball connector can also cut down on servo buzz by helping the geometry of your linkage. In installations where different threads are used, the Sullivan Products 12-inch 2-56 All Thread Rods can be used to splice the linkage.

Hitec RCD (hitecrcd.com) HS-7245MH servos were used on all controls, with Hitec extensions used where needed. Hitec sells replacement servos for most ARFs. Many of the company's servos are programmable, allowing for easy installation and the ability to reverse or adjust each servo without the transmitter.

Although the landing gear on the PT-19 has never been an issue, shock absorption was needed for a larger version. Robart Manufacturing (robart.com) offers many building supplies and accessories for repairs and enhancements of all sizes of model aircraft. The company has mechanical retracts for aircraft that weigh less than 2 pounds, and its Hinge Point system is perfect for repairing worn-out hinges on foam ARFs or upgrading a foam ARF with flaps. I purchased a set of PT-19 landing gear struts to add scalelike looks, but more importantly, to protect the airframe with the shock absorption.

Search for Earl Stahl PT-19 plans and take a look.

Until next time, fly safely! »



The Robart Manufacturing PT-19 struts add a scalelike appearance and airframe protection, making lamination for tip surfaces easy and rewarding. The PT-19 has five laminated parts.

FMS 850mm Ranger PNP

A simple and affordable nod to general aviation

Although not a true scale model, the Ranger's lines and in-flight persona combine to make it appear to be a convincingly Cessna-like general aviation aircraft.

In 2019, FMS announced and released a new high-wing, EPO foam-composition model christened the Ranger, in three sizes. First out of the gate was a 48-inch wingspan version. A quick blast of the manufacturing shrink ray resulted in a smaller, true park flyer-size 33.5-inch wingspan version.

With but a page or two left on the 2019 calendar, FMS upsized the Ranger by releasing it in a relatively jumbo-size 71-inch wingspan version. The Rangers bear more than a passing resemblance to the ubiquitous, tricycle gear-equipped Cessna 150/152s of general aviation fame. All three Ranger variants are distributed in the US by Horizon Hobby. The focus of this review is the 33.5-inch (850 mm) Ranger.

The model is a PNP (Plug-N-Play) kit. It comes out of the box with four 1.9-gram servos and a 2S LiPo battery-based brushless electric-power system that is already installed in the airframe. An impressively bright white, cowling-mounted, "always on" LED landing light stands out as a feature not typically included in a park flyer model of this size and class.

All control rods are assembled and in place. Larger models typically employ EZ-link style connectors on the servo end of the control rods, allowing pilots to easily adjust the neutral position of the control surfaces, but the little Ranger uses Z-bends at both ends of the control rods. To facilitate any adjustments of the control surface neutral positions, U-shaped bends are located near the midpoint of each control rod.

The factory-installed power system includes a 2315 3,850 Kv brushless outrunner, a JST-style connector equipped with a 12-amp brushless ESC with integral BEC, and a 6 x 5-inch propeller. Completion of this model requires a four-channel receiver and a 2S 800 to 900 mAh LiPo battery.

One affordably priced receiver that pilots might wish to consider for use in this model is the recently released Spektrum AR410 receiver. Touted as

The little Ranger can easily be assembled and readied for its maiden flight at a park. With no adhesives required, pilots need only to supply a four-channel receiver and attach the wing and main landing gear.

Photos by Jon Barnes

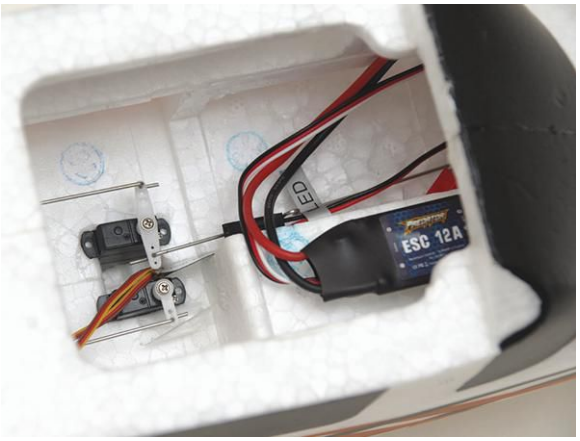
SPECIFICATIONS:

TYPE: Electric-powered high-wing trainer
SKILL LEVEL: Beginner
WINGSPAN: 33.5 inches
LENGTH: 25.8 inches
WEIGHT: 10.3 ounces
PRICE: $129.99
INFO: horizonhobby.com

FEATURES:

- General aviation-inspired styling cues and orientation-enhancing graphics scheme
- Bright white, cowling-mounted LED landing light included
- Completion requires nothing more than a four-channel receiver and a two-cell 850 mAh LiPo battery
- Wide-set tricycle landing gear contributes to good tracking during ground maneuvers
- Replacement parts are relatively inexpensive

The belly-mounted battery bay can accept slightly larger packs than the recommended 2S 800 mAh LiPo batteries. Pilots should ensure that the hatch retention magnets are securely glued in place.



The control surfaces are fired by four factory-installed 1.9-gram servos. All pushrods utilize Z-bends on both ends. The included ESC comes equipped with a JST-style connector.

being a full-range sport receiver, the AR410 also boasts a conveniently compact form factor and weighs a feathery light 1/4 ounce.

Assembly of the 850 mm Ranger can be completed at the field. A single fastener holds the one-piece wing in place on top of the fuselage. A spare fastener was included in the box. The plastic wing struts are preattached to the underside of the wing, with the other ends snap-locking into slots on the sides of the fuselage.

Although the steerable nose gear is installed at the factory, pilots will need to mount and secure the wide-set main gear assembly to the underside of the Ranger using the included fasteners. Many pilots will be able to complete the assembly with nary a glance at the online assembly manual, but those who prefer to glean each detail and feature of their new model by reading the entire manual might notice an apparent anomaly or two.

The manual mentions a "three-in-one integrated receiver" and GPS, but neither is included with this PNP version of the Ranger. The manual also somewhat erroneously illustrates a six-channel receiver. Although pilots can elect to use a receiver with additional channels above and beyond the minimum four channels that are required, doing so comes with the caveat of increased flying weight, higher wing loading, and higher net stall speed.

The battery bay is located on the underside of the Ranger, slightly aft of the nose gear. The battery hatch is magnetically retained at its front edge with the aft edge featuring a foam tongue that indexes into the fuselage.

The hatch magnet is held in place with a small piece of fiber tape, which came loose during the maiden flight, allowing the battery hatch to drop free and flutter to the ground. A few drops of carefully applied foam-safe CA adhesive were needed to rectify this minor issue. It would have been a better design if the battery hatch was engineered to open in the other direction.

The battery bay can accept 2S battery packs that are larger in capacity than the recommended 800 mAh size, but those that are long might be difficult to shoehorn into the available space.

Using an Eagle Tree eLogger (eagletreesystems.com), the brushless power system that is included with this model showed a maximum static reading of 75 watts at wide-open throttle. With the model coming in at an all-up weight of 10 ounces (using an E-flite 2S 800 mAh LiPo battery), this calculates out to a peppy 120 watts per pound of performance.

Pilots of a variety of skill levels will find that the Ranger offers a pleasing amount of power and performance. Takeoffs can be slow and scalelike or quick and aggressive. With the control throws cranked up a little, the Ranger will happily execute aileron rolls and loops. The latter will require judicious throttle use and a slight diving entry to retain enough energy to make it cleanly over the top.

Knife-edge flight is possible, but the model does pull aggressively toward the canopy. The limited amount of compensatory elevator that is required during inverted flight suggests that FMS has the battery placement and center of gravity optimally located.

The chosen graphics scheme, with its abundance of multicolored swooshes that adorn the top and side and an array of rectangular bars arranged on the underside of the wing and horizontal stabilizer, offers newer pilots solid in-flight orientation cues.

Other relevant performance data that might be of interest to potential purchasers of this park flyer is that it has a wing loading of approximately 7.7 ounces per square foot (a wing cube loading of 6.6). Using 2S 950 mAh LiPo battery packs, I was routinely able to achieve flight durations of 5 to 6 minutes.

A full selection of spare parts for this model is available from Horizon Hobby. The relatively low prices for the parts should help lessen the sting of any unexpected and abrupt contact with terra firma.

Although floats can be added for the 1,220 mm and 1,800 mm-wingspan versions of the Ranger, no specific floats are listed as being an option for this smallest member of the family.

Because of this model's all-up flying weight of 10 ounces, it is best flown on calmer days. This aircraft's modest radio system and battery requirements, coupled with its high wing and tricycle gear configuration, offer newer pilots a low-cost, semiscale, general aviation-based airplane that can easily be flown at a local park or ballfield. »

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Tiger Moth Cockpit Door Latch

The components of the latch are shown, with the most important part being the 3/4-inch spring. Roughen the aluminum for better adhesion.

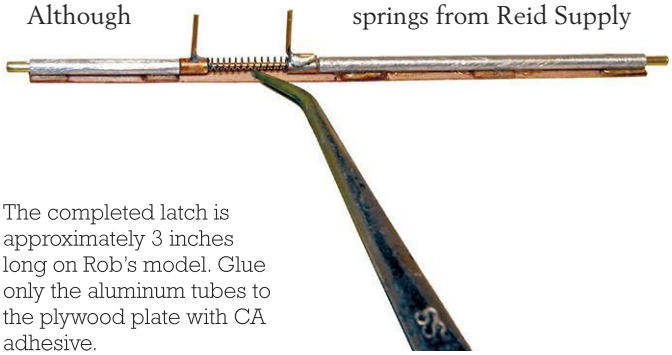
Whenever I take my 66-inch de Havilland Tiger Moth to the flying field, I get comments on the cockpit doors—specifically, the latches that keep the doors reliably closed when the model is in flight.

I made the doors from fiberglass using my "quickie mold" process that I've described in this column in the past, although I have been known to do this fairly simply by trapping a few layers of fiberglass and epoxy between sections of waxed paper and taping the mess to the side of the model. Although the waxed paper does have a built-in release agent, it works more reliably if it is also coated with a release agent such as polyvinyl alcohol.

The door release mechanism is actually fairly simple which, in turn, improves its reliability.

Although my Moth is nearly $^1/_5$ scale, a look at some drawings showed that the latch—a long box tube with retractable pins at each end—was a scant $^3/_{16}$ inch or so in overall width, or approximately an inch on the full-scale aircraft. I could not find drawings or photos of the internal mechanism, but spring-loaded tubes seemed as though they would work on the model, and it would make sense that the prototype had them as well.

The key component is the $^3/_4$-inch long x $^3/_{32}$-inch diameter compression springs from Reid Supply Company (reidsupply.com). The rest of the materials came from my tube and rod supply.



The completed latch is approximately 3 inches long on Rob's model. Glue only the aluminum tubes to the plywood plate with CA adhesive.

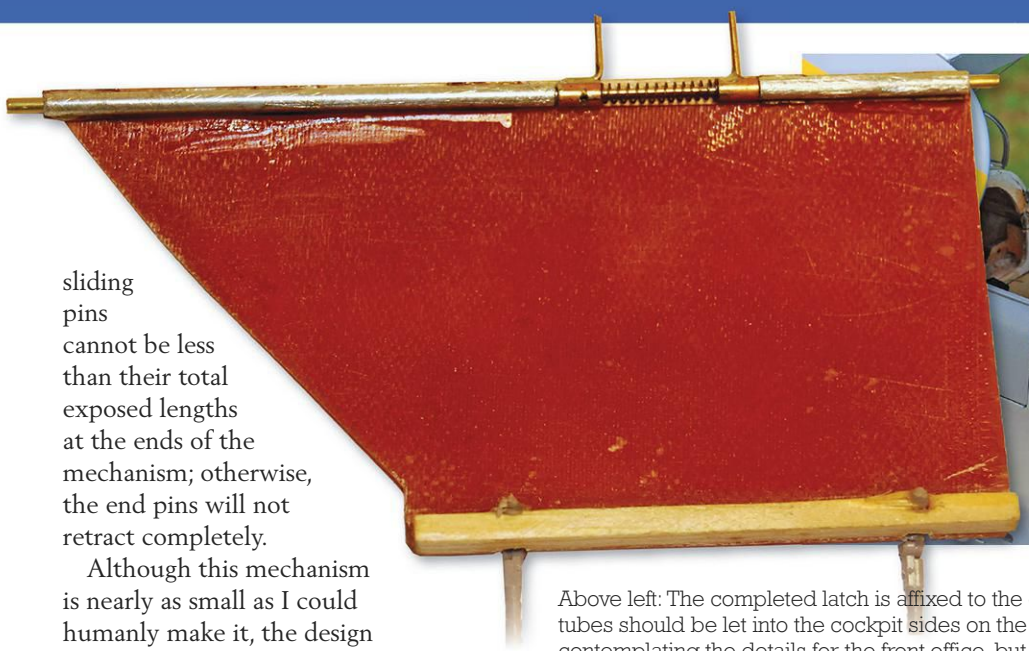
The theory behind the design is that two opposed, sliding $^1/_{16}$-inch diameter pins would each ride in sections of aluminum $^3/_{32}$-inch diameter tube. The aluminum tubes are fixed to plywood pads on a plywood plate. The pads are needed for clearance for the sliding mechanism and spring.

The $^1/_{16}$-inch diameter locking pins at each end are actually tube stock. These slide on .030-inch wire rod that is soldered inside of one pin assembly, but are left free to slide in and out of the other to act as a guide, with the spring in the middle. The .030-inch wire rod keeps the opposing tubes and pins in alignment while also trapping the spring and keeping it centered.

The outer ends of the $^1/_{16}$-inch diameter pins protrude beyond the ends of the aluminum tubes, slotting into holes in the edge of the cockpit opening and keeping the door closed. Brass bushings on either side of the spring are soldered to the sliding pins and keep everything together. A couple of $^1/_2$A Robart Manufacturing (robart.com) pin hinges hold it on the model.

A further scale wrinkle here is the two vertical posts that are soldered to each of the sliding pin's bushings that provide the pilot (or you!) the means of retracting the pins to open the door. I used brass posts on mine, but I recommend steel after living with them for a while.

After the internal mechanism was fabricated, it was a simple matter to box it all in with either plywood or plastic sheet, leaving a slot for the vertical posts at the top. Keep in mind that the total combined travel of the



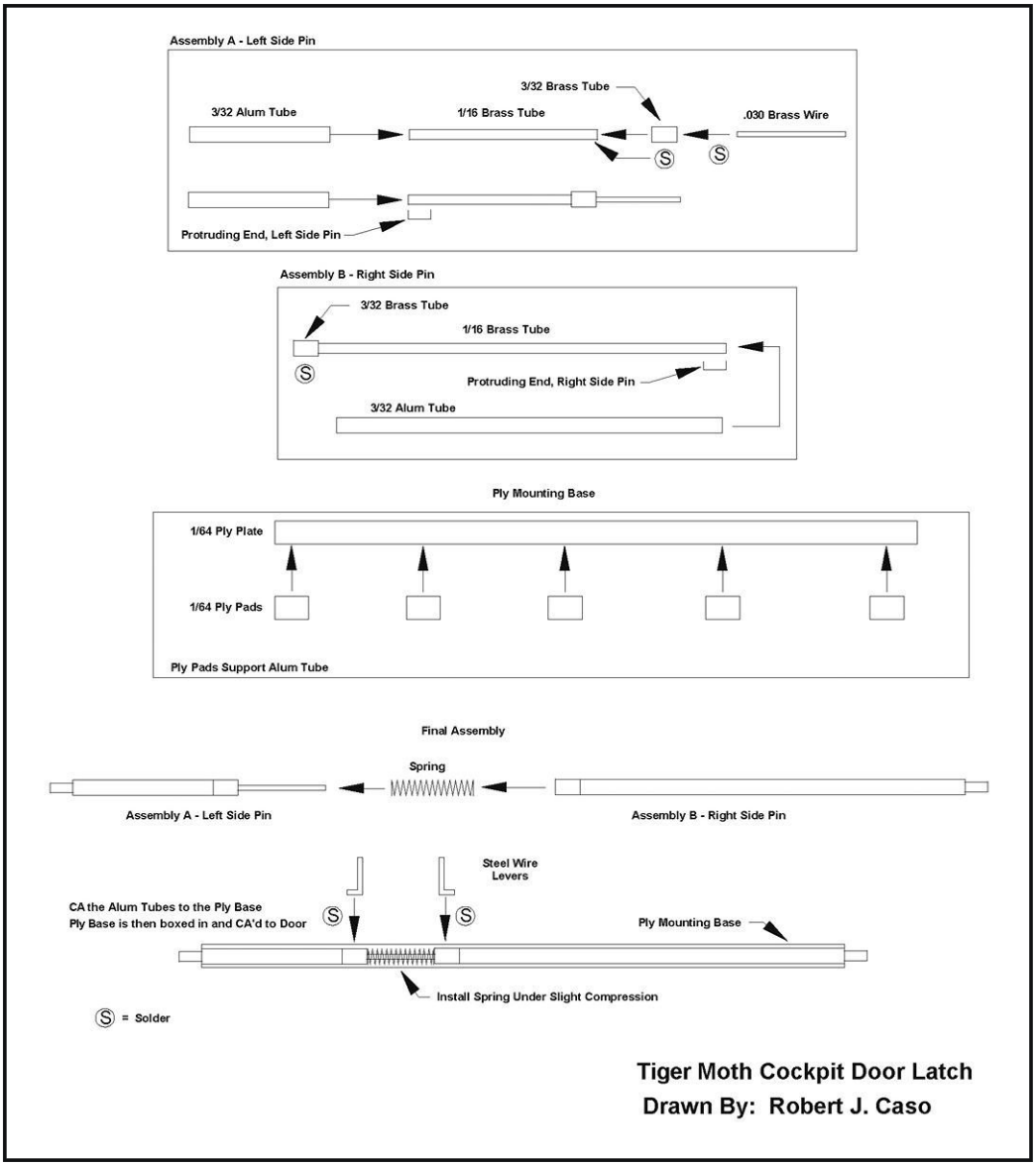
Above left: The completed latch is affixed to the glass cockpit door. Corresponding tubes should be let into the cockpit sides on the fuselage. Above right: Rob was still contemplating the details for the front office, but the door is shown securely latched to the model.

sliding pins cannot be less than their total exposed lengths at the ends of the mechanism; otherwise, the end pins will not retract completely.

Although this mechanism is nearly as small as I could humanly make it, the design could easily be scaled up by simply substituting the components in the drawing with larger telescoping sections of rod and tube. I needed two of these, and although the first one took me more than an hour to make, the second was done in approximately 20 minutes.

A couple of fabrication tips include deburring the inside of the tubes after they are cut to length and using solder sparingly. Possibilities abound for this design to be used in other ways, such as for a bomb drop or a single-sided mechanism. The pins could be hooked up to a servo-mounted cam arrangement or to cables.

In retrospect, this design couldn't be simpler, and the simplest designs are generally the easiest to make and the most reliable. »



With this diagram of the mechanism, note that only the diameter dimensions are given because the lengths should be customized to the model.

Multiplex Challenger Bi-Plane Indoor Edition

A fun and durable profile bipe

I've always been fascinated by flat-plate-style flying models and the way that they seem to throw Bernoulli's principles out the window in a triumph of brute physics over elegant aerodynamics. Like the bumblebee, science says that they shouldn't fly, but they do—and quite well.

In the tradition of some model airplanes dragging Mr. Bernoulli through the mud comes the Multiplex 3D-capable Challenger indoor flyer. Made of EPP foam and sporting a distinctive paint scheme, this biplane looks to offer high-performance aerobatics that are suitable for indoor flying in a small package.

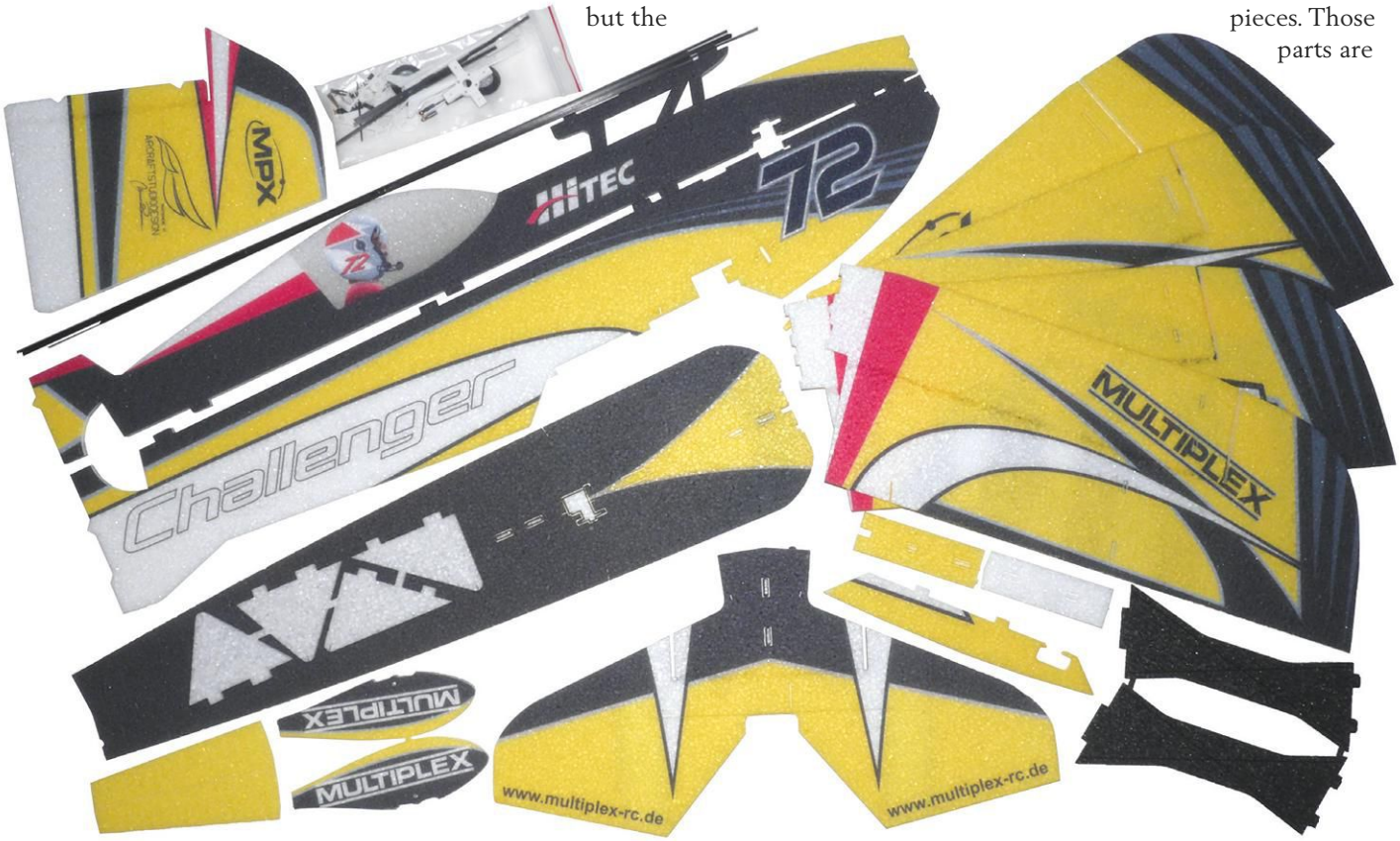
Unsurprisingly, a model composed of flat parts comes in a flat package. All of the subassemblies, parts, and the manual are neatly packed in a surprisingly thin box. The body and wings are constructed from durable, 6 mm EPP foam that is preprinted with the distinctive color pattern. Control surfaces are hinged using a beveled crease in the foam.

The manual is printed in multiple languages that share a common set of black and white photos. The assembly steps are on separate pages from the photos, so I recommend carefully reading all of the steps and viewing the associated photos before starting. None of the parts are labeled, but the manual text describes each part, and I generally had no issues finding the parts I needed with the help of the photos.

It wasn't immediately obvious, but all of the plastic parts are 3D printed using Fusion Deposit Modeling—the same type of 3D printing commonly seen in hobby use.

Although the manual recommends adhesives that are common in Europe, you can (and I did) completely build the model using medium CA glue. Note that CA kicker (accelerator) can be used, but it should be done sparingly for the best strength.

Build: Assembly starts with the tail pieces. Those parts are



This is how the flat EPP foam, with its colorful preprinted scheme, comes out of the box.
Photos by Lee Ray and Fitz Walker

FITZ WALKER
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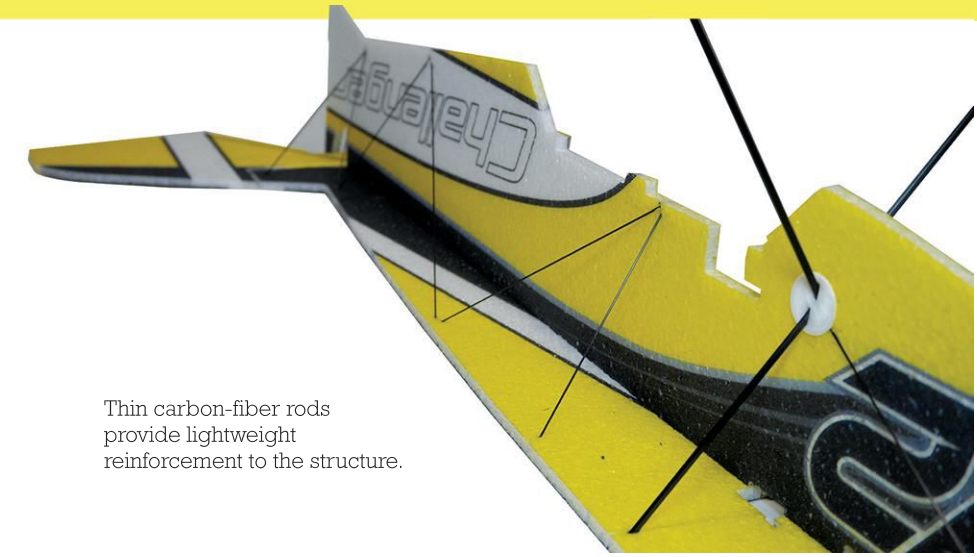

Thin carbon-fiber rods provide lightweight reinforcement to the structure.

reinforced by embedding various lengths of small carbon-fiber rods. The entire model is structurally strengthened by a veritable framework of carbon-fiber rods that must be cut and glued into place as the model is built up into a 3D subject.

Factory precut slots and grooves are provided for all of the reinforcement rods to slide into. I recommend labeling all of the carbon-fiber pieces and using a caliper to note the various thicknesses of the rods.

This is the most involved and time-consuming step, but without the rods, the thin foam would lack structural integrity and be too flimsy for controlled flight. It is easy to do, but it will take a little time and patience.

Nearly all of the parts key together in unique ways to prevent assembly errors. However, I had a brief pause when I needed to reference various pictures in order to determine the proper orientation of the wings. In fact, I came uncomfortably close to gluing in the bottom wing upside down.

I used the recommended motor package, which includes a 15-amp ESC, a 1,050 Kv brushless motor, and 9 x 5 GWS propeller (hobbyking.com). Note that the propeller hub's hexagonal depression didn't fit the stepped washer hub for the motor shaft, so I slightly drilled out the hub with a roughly 8 mm drill bit. I also enlarged the cutouts for the tail servos with a hobby knife so that the Hitec HS-45HB servos (hitecrcd.com) would fit. The manual appears to have a slight error in the brass coupler length for the ailerons (14 mm vs. 20 mm). It is correct on the parts list, but not on the assembly text.

The receiver, battery, and ESC are simply attached to the airframe with Velcro.

With the radio hooked up, the control throws—especially the ailerons—look to have excessive deflection. However, lots of exponential is prescribed by the manual to tame things down.

Flying: Although the Challenger is generally meant for indoor flying, my first flights were out in the open on a day with a light, variable breeze. Despite the scary control throws, the model handled smoothly and was not at all twitchy. As a precaution, I programmed in an aileron low-rate setting, but quickly went to the normal rates when it was apparent that I had nothing to fear.

This is not a model that you fly fast, so you need the extra throws. All of the controls were crisp and smooth. I was immediately at ease experimenting with all types of maneuvers and throwing the sticks in the corners. Surprisingly, it was very controllable in the roughly 5 mph wind during my outing.

Control authority in forward flight is maintained to basically zero airspeed. This is great because this airplane excels at flying slowly. It also didn't seem to care much about at what attitude it was placed. I just pointed it in the direction I wanted it to go, wings level or not.

Knife-edge flight can be done at crawling speeds with rudder authority to spare. Knife-edge loops are also easy to do. The roll rate is brisk at full deflection.

I don't claim to be an expert 3D flier, but the Challenger seemed to perform all of the advanced aerobatics in my mental library. I also found that the model didn't seem to accelerate too much on the down verticals, probably because of the drag of the carbon-fiber rod reinforcements that were hanging out in the breeze. This low acceleration rate looks better because maneuvers will have a more consistent speed.

I found it to be a great model with

The aileron servo uses an arm extension and adjustable carbon-fiber pushrods for large-deflection travel.

which to experiment. Most maneuvers needed only a light touch of the controls. Although it is not an airplane for beginners, intermediate pilots should have no problem flying it on calm days.

Because I rarely went past half throttle, the flight time using a 3S 350 mAh LiPo battery was quite good. I easily got 5- and 6-minute flights on a single charge. When I elected to use full power, I had unlimited vertical climb, but horizontal, full-throttle flight quickly hit a drag wall, so don't expect a speed demon.

Although I wasn't able to truly test indoor flying with the model, I did fly it in my tree-lined cul-de-sac with no issues maneuvering in such a confined space. Plus, there is something extra satisfying in being able to fly right outside of one's front door.

Conclusion: After spending some time flying the Multiplex Challenger, I found that its inherent stability, yet high maneuverability, make it a fun airplane with which to try new techniques. It excels in the low-speed flight envelope with gravity-defying, slow-speed handling.

Both advanced and intermediate pilots will find a lot to like about the Challenger. »

SPECIFICATIONS:

SKILL LEVEL: Intermediate/advanced
WINGSPAN: 33.46 inches
LENGTH: 35 inches
FLYING WEIGHT (LISTED): 7.93 ounces
FLYING WEIGHT (AS FLOWN): 8.5 ounces
MOTOR: ROXXY C27-15-1050 Kv
PROPELLER: GWS 9 x 5
BATTERY: 3S 350 mAh LiPo
CONSTRUCTION: Carbon-fiber reinforced EPP foam
RADIO GEAR: Hitec Aurora 9X transmitter; Hitec Optima 9 reciever; Hitec HS-45HB and HS-65MG-plus servos
PRICE: $76.99
INFO: hitecrcd.com

FEATURES:

» Bright, colorful preprinted EPP components for fuselage, wings, tailplane, fin, and undercarriage
» Convenient wheels for smooth takeoffs and landings
» Five-minute flight times
» Includes all-plastic parts, small items, and linkage components required to complete

Fitz Walker had no issues flying the Challenger outside in up to 5 mph wind.

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Mason Hutchison got his start in aeromodelling at a young age and pursued his love of aviation throughout his life, eventually earning a degree in aviation engineering at New Mexico Tech. Since then, he has worked at Scaled Composites designing, building, and testing landing gear for Virgin Galactic's WhiteKnightTwo, the mother ship to SpaceShipTwo. Mason went on to become lead design engineer for the flight control system of Stratolaunch, the recently flown largest-wingspan airplane in the world.

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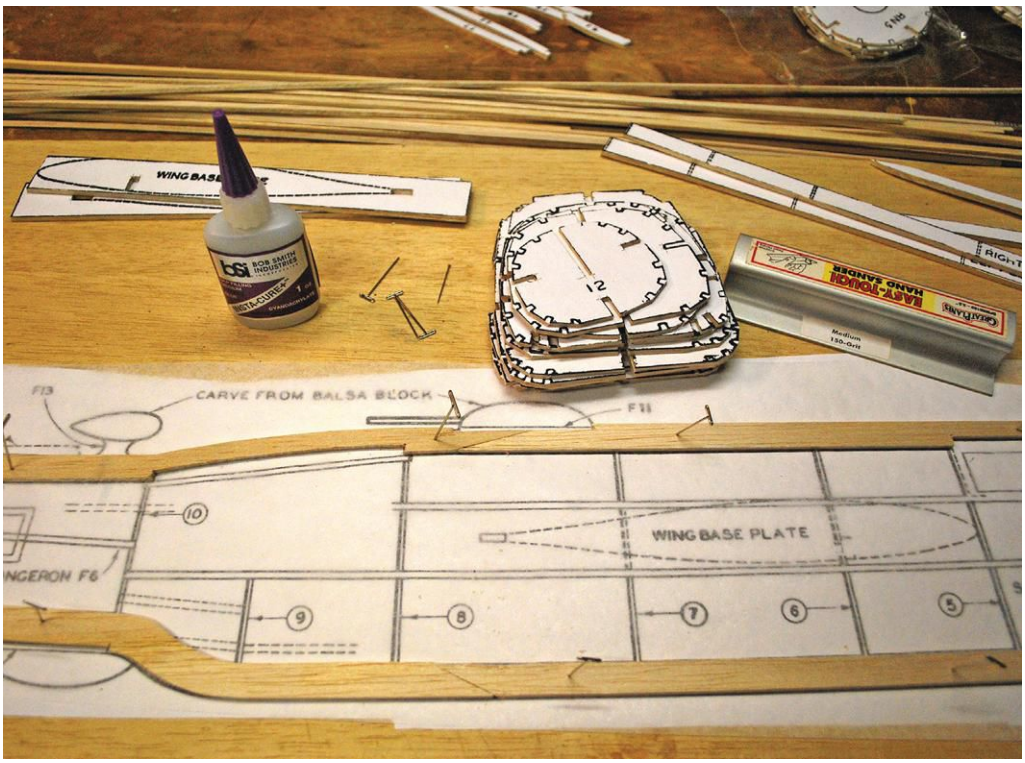
Jeff Troy
jefftroy@aol.com

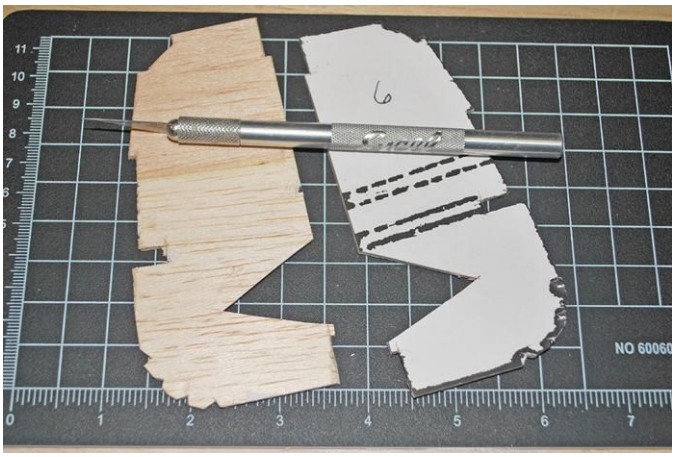
Fuselage and nacelles



The fuselage construction begins by laying out the plans, protecting them from adhesives with parchment paper, and pinning down the keel parts. Keel parts form the outer shape of the fuselage.

If you're new to "Model Builder," my current project is a 200% enlargement of the Comet Models A-26 Invader. Previous installments showed how I cut the shaped parts using paper templates from enlarged plans, followed by basic construction of the wing panels. Next came modifications for ailerons, split flaps, and navigation lighting.

With the wing panels nearly completed, my attention turned to the Invader's fuselage and nacelles. I taped the fuselage drawing to my work surface and covered it with parchment paper. I find that parchment has greater resistance to CA adhesives than waxed paper or film backing, although certain brands seem to demonstrate this better than others. My adhesive choices are bSi (Bob Smith Industries; bsi-inc.com) Insta-Cure thin and Insta-Cure+ medium CA.



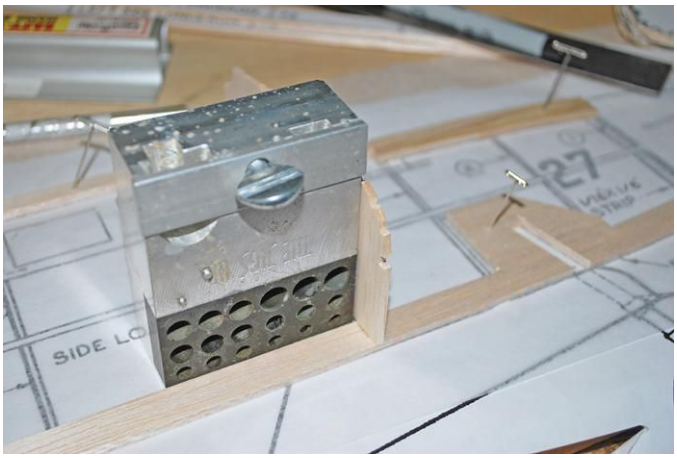
Cut notches into the formers for the side-forming longerons. Mark the stringer notches with triangular cuts or pencil marks on the edges. Cut each former in half, top to bottom.

Begin by peeling away the template paper from the keel parts and pinning these parts down over the plans. Use a bar sander to ensure the perfect mating of glued angles.

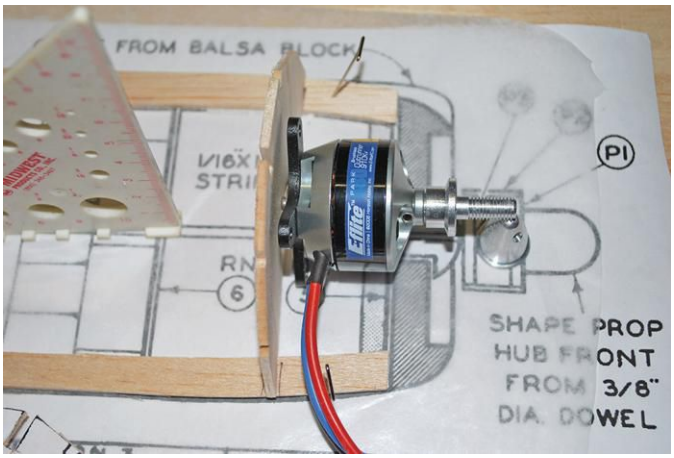
The fuselage formers (bulkheads) must be modified before they can be installed. Notches for the longerons and stringers must be cut into each former, but for now, you should only cut those for the longerons. The stringer notches should not yet be cut but should be marked by small nicks or pencil lines on the edges of the formers.

After cutting or marking the various notches, cut the formers in half from top to bottom. Cutaways can now be made to allow the wiring to pass for the fuselage servos, lighting components, and the retractable nose gear unit. Keeping it simple, I stacked the halves of each former and made triangular cuts that will mirror each other when the halves are mated.

The plans call for the right side of the fuselage to

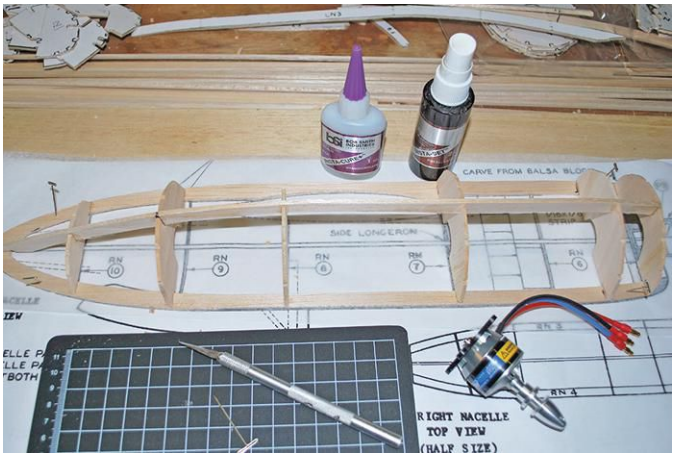


One at a time, use a triangle or an object with a 90° edge to install the formers. The aluminum body of The Jigs Up tool (thejigsup.net) is an ideal triangle substitute.



Nacelle construction echoes that of the fuselage, although the F6 former must be relocated to accommodate the Park 480 brushless motor or a motor of your choice.

Fit the forward and rear longerons into the former slots. Use a hobby knife to adjust the slots so that the longerons can run straight and true along their length.



The LN7 and LN9 formers are only tack-glued to the keel parts. These will be glued securely after being aligned with the wing LEs and TEs.

be constructed first, so you should mark the left side of each former number on the template paper and set it aside. One at a time, nose to tail or vice versa, use a triangle or a 90° upright to ensure that each right-side former half is vertical as you glue it in over the keel.

The longerons run from nose to tail on the fuselage sides, fitting into the wide notches in the formers. Use your hobby knife to adjust any notch that prevents the longeron from running straight and true along its length. With that done, repeat the fit procedure for the rear longeron.

After the longerons run true, get a bit of medium CA glue into the notches and install them. Allow the adhesive to set securely then remove the structure from the plans and pin down the nacelle plans. The right and left nacelles are built over the same drawing, but they are not identical.

Pin down the keel parts and prepare the formers as you did the fuselage formers, noting that formers 7 and 9 must be angled to align with the LEs (leading edges) and TEs (trailing edges) of the wing panels.

Glue formers 5, 8, 9, and 10, but you must decide your choice of motor before installing former 6. This former's location must be altered to allow the propeller adapter to correctly exit the nacelle.

The Park 480 (horizonhobby.com) motor required a forward move, and I also figured in an extra 1/8 inch for the plywood doubler that will be installed over the former.

Because I started with the portside (left) nacelle, former N7 would have to lean slightly forward and N9 would lean rearward. I used only a drop of medium CA at their attach points so that the angle of these formers could easily be adjusted to align with the wing panel. I then fitted the longerons, adjusted the former notches, and glued them in.

In my next installment, I'll complete the basic construction of the fuselage, the nacelles, and the horizontal and vertical stabilizers. Modifications for installing the FMS retracts (fmsmodel.com) and the RAM navigation light systems (ramrcandramtrack.com) will follow in subsequent installments.

As always, I hope to have you with me for these fun-filled sequences. »

Lucas Weakley
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Payload drop

The loosely organized RC club at Scaled Composites (scaled.com) likes to hold design, build, and flying competitions at the Mojave Air & Space Port (mojaveairport.com).

Toward the end of 2019, the idea of implementing an RC version of the widely popular flour bomb competition that is performed in general full-scale aviation was entertained. Rules were made and a date set, and I've been itching to participate ever since!

The rules of this competition are simple. Each participant's score is determined by the weight of the payload dropped, divided by its distance from the target center. A full water bottle weighs approximately 500 grams. If that water bottle is dropped 10 feet from the center of the target, that would be worth 50 points (in the units of grams per foot, which I'm using to keep the point numbers whole). A 10-gram payload at the same distance is worth only 1 point.

Participants drop as many payloads as they can in 5 minutes. Additionally, the center of the target is marked with a wastebasket. If someone drops the payload into the basket, his or her distance to the center is zero, so weight divided by distance (in this case) is infinity. He or she automatically wins.

It's advantageous to carry more weight or have an airplane that can land fast and can be quickly reloaded. You could also bank everything on being as precise as you can and hit the center of the target with a light payload. I'm not as confident in my ability to hit the center as I am in making an airplane that can carry a lot of weight, so I went with the former strategy. My initial thought was to modify my Buster airplane (see my Winter 2018 *Park Pilot* column) with a dropping mechanism.

With some resistance, I decided to carry half-size water bottles stored vertically in the fuselage. Each bottle would get its own servo dropper, and there would be little chance that the bottles would get stuck when they were released.

My resistance came from a concern for the airplane's CG (center of gravity). As I dropped each bottle, the CG would shift either forward or aft, depending on which bottle that I dropped. I would keep the payload bay under the wing, but even with that mitigation, I had to accept that the airplane would fly differently after each drop. Being that this configuration allowed me to carry more bottles than any other, I decided this was acceptable. I could always lighten the water bottles that were farthest from the CG and drop those first.

With this plan, I started building. I built a new, longer tail that would give me more stability. The airplane would be too heavy to hand launch, so I needed to add landing gear. I decided to turn it into a tail-dragger, with a servo-actuated tail wheel for better ground handling. The airframe came in at 6 pounds with the batteries. The four motors produced 10 pounds of thrust at full throttle.

With the airplane ready, I added four servo droppers to the fuselage and cut some foam to guide the bottles out of the bay. I glued zip ties to the water bottle bottoms to secure them in the droppers.

I have a FrSky OpenTX radio, so I programmed in some logic to use a single switch to actuate all of the droppers. It would drop one bottle per momentary flip, starting with the aft-most bottle then forward, aft, and forward. This gave me the best chance of keeping pitch stability while dropping the bottles. I also had an emergency release switch that would drop all of the bottles at the same time if I started to lose control and needed to shed the weight.

I finished all of the modifications before the competition so that I could test the airplane. After trimming the tail wheel with some taxiing, I took off without any payload to test and trim the new tail. I made some adjustments when I landed the airplane

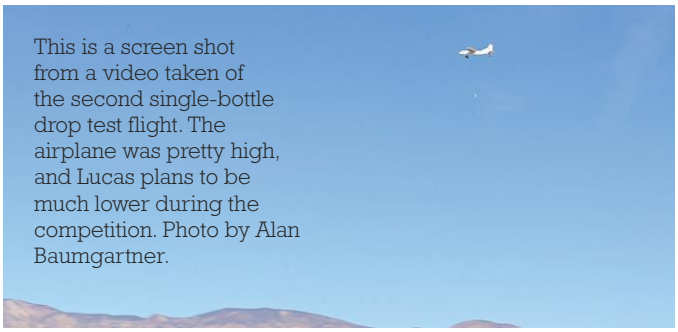
The wingspan of this model is 80 inches, which is hard to sometimes visualize. This photo shows Lucas Weakley with the airplane for scale.

Shown is the completed airplane before flight testing. The new tail extends the fuselage by approximately a foot from the previous configuration.

Lucas designed the droppers using a 9-gram servo to pull a wire linkage through two posts in a 3D-printed body.

Lucas spaced the bottles as close together as possible and made a foam guide to keep the bottles from swinging in the droppers.

After wiring the servos to the receiver, the fuselage sections were connected, and the wing halves were joined.



This is a screen shot from a video taken of the second single-bottle drop test flight. The airplane was pretty high, and Lucas plans to be much lower during the competition. Photo by Alan Baumgartner.

and loaded a single bottle on the dropper that was closest to the CG. This increased the flying weight by 0.6 pounds.

The airplane flew as though it was empty, and I successfully dropped the bottle without adjusting any trim, which was what I expected. When the bottle hit the ground though, the zip tie fell off, so I only had three bottles left.

I opted to carry the remaining three bottles all at once, leaving the aft dropper empty. With an additional 1.8 pounds, the airplane flew heavy. The climb performance was adequate, but I needed to nurse it around the turns. I got as high as I could before I dropped the payload because I wasn't sure what the airplane would do when it lost that much weight.

Dropping all three bottles at the same time didn't cause anything to happen. The airplane just kept flying, and I came in for a landing. The flight test was successful! I lowered the weight of each bottle, implemented the sequential dropping program on my radio, and I was ready to compete!

At the time of writing this column, the competition was delayed because of wind, so I can't say what happened. But the number of people participating is exciting. Another engineer built an airplane to carry 4 pounds of water bottles. Several others modified existing airplanes with droppers, and at least two other competitors are using flight controllers to autonomously fly and release their payloads.

Regardless of the competition's outcome, I had a blast building and testing this configuration. The combination of engineering and technical problems challenged what I had previously done with scratch-building, and I look forward to making more complicated models in the future.

Maybe this competition would be fun at your RC model club. If so, I'd really like to see your creations! »

[*Editor's note: Aircraft weighing more than 2 pounds do not fit the Park Pilot Program guidelines.*]

Don Slusarczyk
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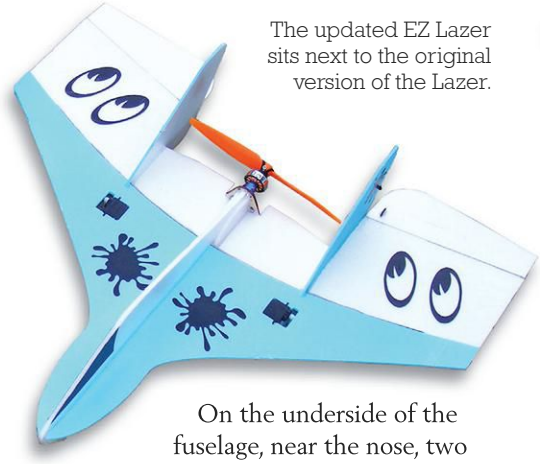
EZ Build RC's EZ Lazer



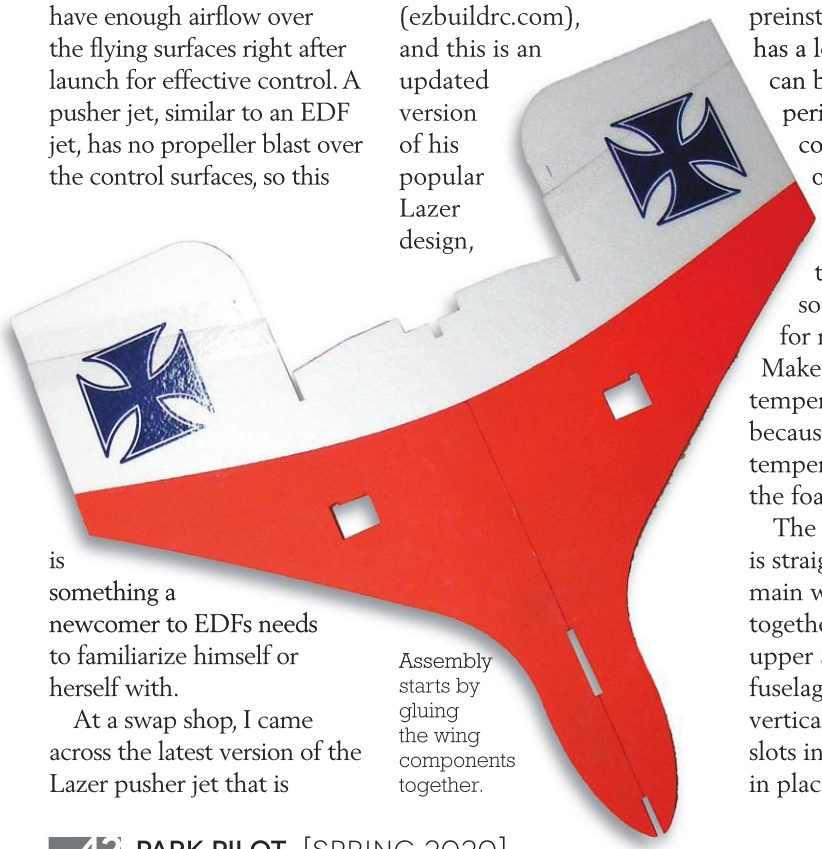
The updated EZ Lazer sits next to the original version of the Lazer.

When a pilot wants to transition from conventional RC airplanes to EDF (electric ducted fan)-powered aircraft, I often recommend a pusher-style jet first before buying an EDF. This is because a pusher jet still has the familiarity of a park flyer, mixed with some characteristics found in an EDF.

The main issue I see with beginners flying EDF aircraft is learning that they need to be thrown hard enough to have enough airflow over the flying surfaces right after launch for effective control. A pusher jet, similar to an EDF jet, has no propeller blast over the control surfaces, so this is something a newcomer to EDFs needs to familiarize himself or herself with.

At a swap shop, I came across the latest version of the Lazer pusher jet that is sold by Dan Greathouse. Some of you might know Dan from his previous RC venture, Lazertoyz, and perhaps you have seen his products at the Toledo Show: R/C Model Expo (toledoshow.com) that is typically held in April each year at the SeaGate Convention Centre in Toledo, Ohio.

Dan is back in the RC business with a new company, EZ Build RC (ezbuildrc.com), and this is an updated version of his popular Lazer design, called the EZ Lazer. This lightweight park flyer is great for getting used to pusher-style jets. A variety of motors can be used to increase performance as your flying skills sharpen.



Assembly starts by gluing the wing components together.

The EZ Lazer comes with prepainted, laser-cut foam parts. The control surfaces are pre-hinged, and the carbon-fiber wing spar is preinstalled. The airframe has a low parts count and can be built in a short period of time with conventional foam glues or hot-melt glue. The hot-melt glue was recommended in the assembly manual, so that is what I chose for most of the build. Make sure to use low-temperature hot-melt glue because some of the high-temperature glues can melt the foam.

The airplane's assembly is straightforward. The main wing pieces are glued together, followed by the upper and lower profile fuselage section pieces. The vertical fins fit into precut slots in the wing and are held in place with hot-melt glue.

On the underside of the fuselage, near the nose, two foam doublers are glued to each side of the fuselage profile for added strength and to create a slot to hold the flight battery. It also serves as a great place to hold the model when you are launching.

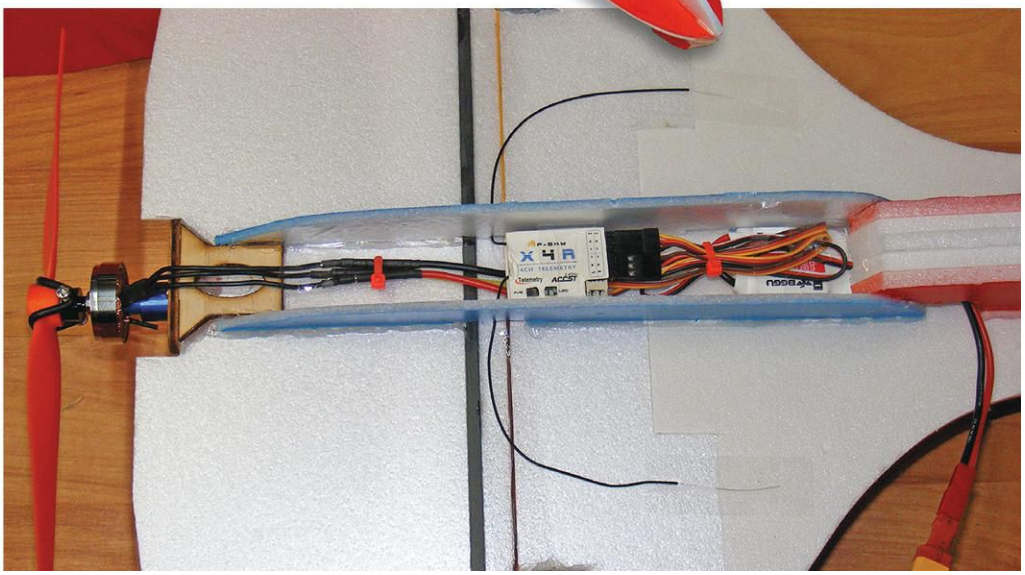
The servos are adhered with clear tape then hot-melt glue is applied around the servo case to secure them. The only place I did not use hot-melt glue was on the control horns. I installed those with some 5-minute epoxy.

A 1,700 Kv motor is recommended and it requires a 12-amp ESC when used with an 8 x 4 direct-drive propeller. A 3S 650 mAh LiPo battery is also recommended. All of these items can be purchased from the EZ Build RC website if you want to buy a complete package.

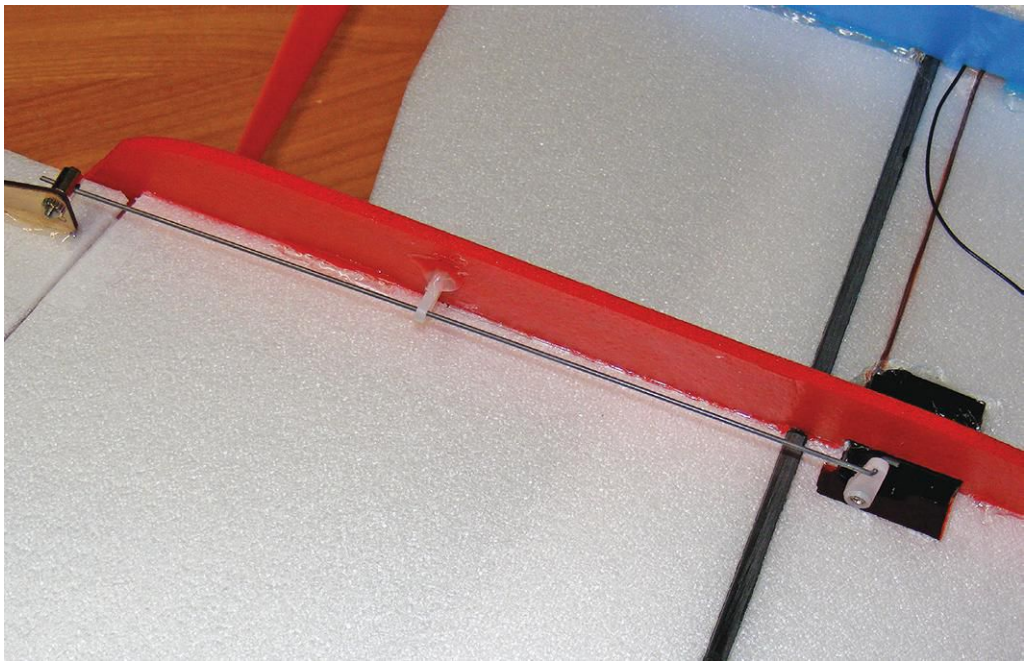
The 1,700 Kv motor comes with a metal motor mount that is screwed to the included plywood motor mount. Hot-melt glue was used to attach the plywood mount to the back of the airframe.

With only two servos, the

Left: The airframe is done after a few minutes using the hot-melt glue gun. Above: All of the required electronics can be purchased directly from EZ Build RC.



The electronics fit nicely in the tunnel on the underside of the fuselage.



A guide prevents the wire pushrod from bowing in flight.

ESC and radio installations take just a few minutes. With the help of some zip ties and a few pieces of clear tape, the electronics fit nicely into the tunnel on the underbelly of the airplane.

Because this is a flying wing, you will need elevon or delta mixing activated on your radio. Set the aileron and elevator throws to approximately $^1/_2$ inch up and down for your initial flights. Check the propeller rotation and verify that the propeller is installed in the correct direction. Putting a propeller on backward is easy to do on a pusher.

The final check before the maiden fight is the CG (center of gravity) location. With the recommended electronics and LiPo battery, the CG on the Lazer was approximately .7 inch in front of the servo slots. I added a few clicks of up-elevon trim (roughly $^1/_8$ inch up) then I was ready for the maiden.

With approximately $^2/_3$ throttle, the aircraft should be launched straight ahead with a firm throw, with the pilot taking care not to roll his or her wrist left or right. The Lazer should start to climb out.

Mine only required a few clicks of trim for it to fly how I liked. With this power setup, I was able to fly in a football field-size area at my local park. The aircraft's light weight and motor/propeller combination provided plenty of power for climbing, looping, and rolls. It also flew nicely at half throttle, doing lazy laps around the park.

If you are looking for an easy way to get into park flyer jet pusher aircraft, the EZ Lazer just might be the airplane for you. »

Ben Saks checks out Tom Iacobellis' biplane pusher at the 2010 Indoor FF Nats. Photo by John Kagan.

Rachelle Haughn interviews
Ben Saks

In 2019, Ben Saks was able to share with the world two of his passions: model aviation and filmmaking. The Indoor FF (Free Flight) pilot began competing in the AMA Nats in roughly 1998 and has competed in a world championship. In recent years, through a Kickstarter campaign, he was able to use his background in aeromodeling and his experience with film to create a documentary about FF called *Float* (floatdocumentary.com). He shared some information about the path that led to the film's release.

Rachelle Haughn: *When and how did you learn to fly model aircraft?*
Ben Saks: I started building and flying in Science Olympiad and then joined the Cleveland Clowns indoor [FF] group. I was mentored by the late Dr. Vernon Hacker, who was a great Indoor FF builder and mentored many young builders in the area.

RH: *What was the first model that you built or flew?*
BS: I think the first one was a Delta Dart kit, and then I built a plane for the Science Olympiad event, The Wright Stuff.

RH: *In what genre of model aircraft did you compete?*
BS: I competed at many invitational, regional, and state Science Olympiad contests where I won numerous medals. I also competed at regional Indoor contests held in Michigan, Ohio, and New York.

I competed at the USIC [U.S. Indoor Championship; AMA Indoor Nats] for a number of years, and in 2002, I was a Junior on the US F1D team and competed in Romania at the [FAI] F1D World Championship [for Indoor Model Aircraft].

RH: *When did you compete?*
BS: From about 1998 to 2012.

Ben Saks (R) at the 2002 FAI F1D World Championship for Indoor Model Aircraft in Romania. He finished in second place as a Junior and third overall. The only Senior who had a better flight time than he did was Jim Richmond. Ben's teammate, Doug Schaefer, was the Junior World Champion that year.

A young Ben competing in Indoor FF.

Ben (L) talks to Jim Richmond about F1D at the Nats. Jim was featured in *Float*. Kagan photo.

RH: *Do you still build or fly?*
BS: I still build a little, but I do not fly much these days!

RH: *What inspired the* Float *documentary?*
BS: My friend, the director of the film, Phil Kibbe, thought the planes were beautiful and that the people who flew them were interesting characters, so he decided to make a film about F1D and I would help produce it.

RH: *What was your role in creating it?*
BS: I was the producer, and I am also a subject in the film and narrate parts of the film.

RH: *How did you use your experience with model airplanes while making the documentary?*
BS: I think the main thing was access.

Ben Saks (L) and Morgan Slater working hard at the 2010 Nats. Kagan photo.

Ben in a scene from the documentary.

Above and right: Ben at a demonstration he held at the Pittsburgh office of Google in 2012.

I knew all of our main characters well and that allowed us to gain access to them, whether at a contest or traveling to their home workshops to interview them. I also drew from my experience at contests to be able to know when the exciting moments were happening to make sure we had them on camera!

RH: *What other documentaries would you like to make?*

BS: My intention is to move forward working on films that tell meaningful stories, that are visually interesting, and that challenge me.

Right now, Phil and I are in preproduction on a documentary about the famous four-round boxer, Eric Esch, aka "Butterbean." »

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- Inspect your model before every flight to make certain it is airworthy.
- Be aware of any other radio frequency users who may present an interference problem.
- Be courteous and respectful of other users of your selected flight area.
- Choose an area clear of obstacles and large enough to safely accommodate your flying activity.
- Make certain this area is clear of friends and spectators prior to launching your aircraft.
- Be aware of other activities in the vicinity of your flight path that could cause potential conflict.
- Carefully plan your flight path prior to launch.
- Abide by any and all established AMA National Model Aircraft Safety Code items where applicable and appropriate.

PARK FLYER DEFINITION

Park Flyer models will weigh 2 pounds or less and be incapable of reaching speeds greater than 60 mph. They must be electric or rubber powered, or of any similar quiet means of propulsion. Models should be remotely controlled or flown with a control line, remain within the pilot's line of sight at all times, and always be safely flown by the operator.

A Park Flyer site can be either an outdoor or an indoor venue. When flying at sites specifically designed for Park Flyers, the pilot will keep the model within the established flight boundaries of the field. Members need to take into consideration several factors including piloting ability, weight, size, and speed of the Park Flyer model to determine if a Park Flyer site is an appropriate venue for flying a particular model. The test should be, "Can I fly this model safely and quietly at this flying site?"

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