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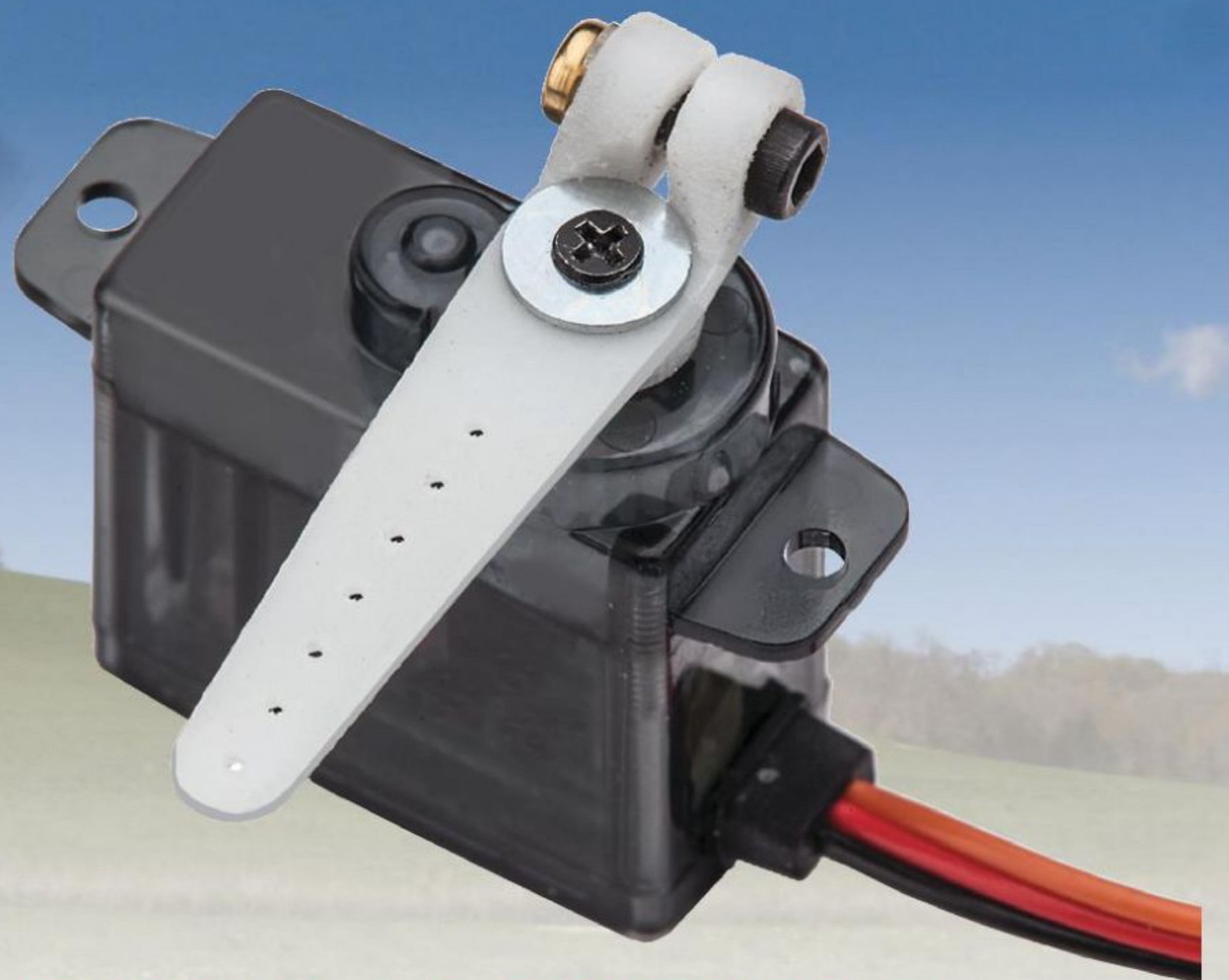
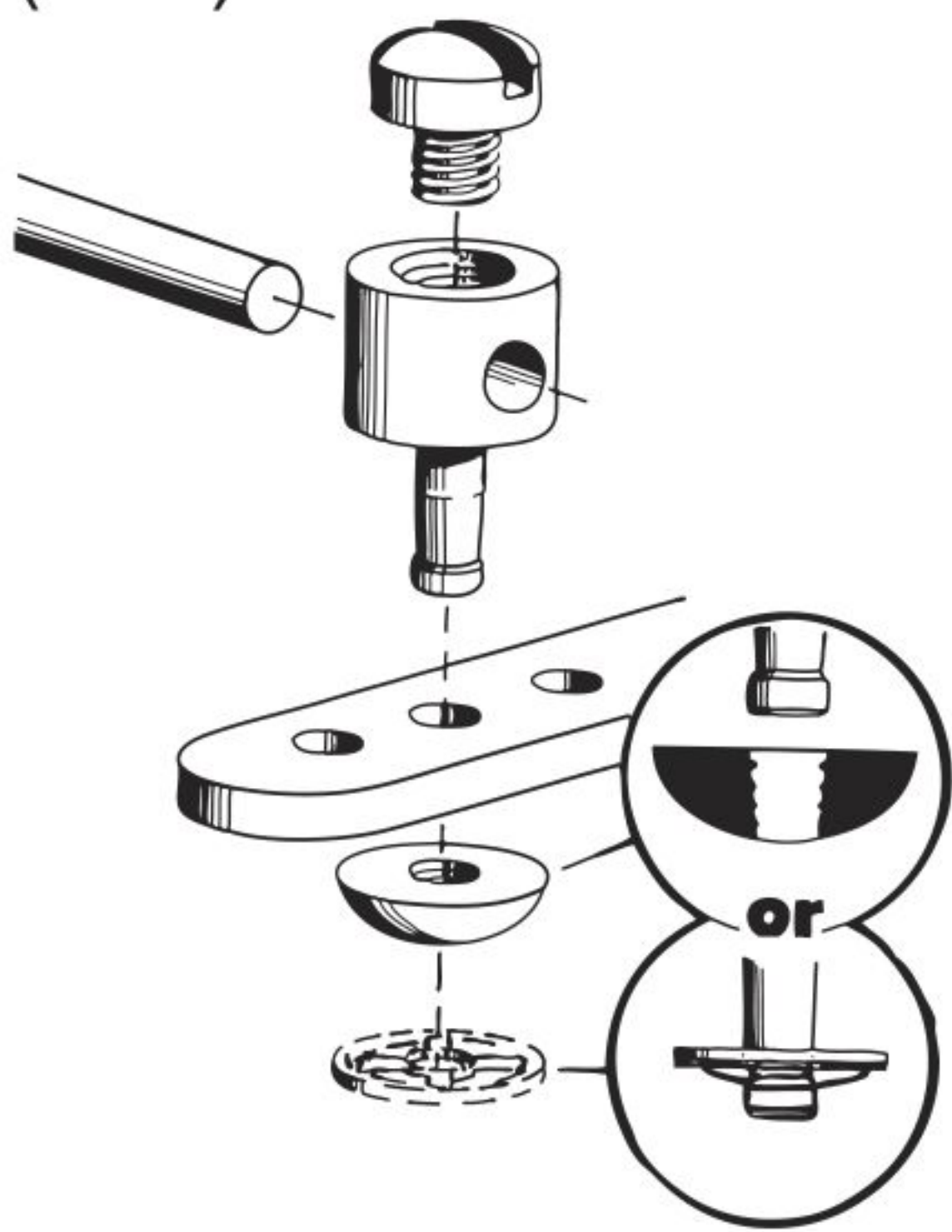
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Number 5
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ON THE COVER

If you've ever envied the speed and maneuverability of electric jets and thought they were too challenging, our "Life in the Fast Lane" story may change your mind. (Photo by John Reid)

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BY DEBRA CLEGHORN



JOIN THE JET SET

Just like their full-size counterparts, RC jets are the leading edge of aviation: they're fast, maneuverable, and look (and sound) cool. And even better, today's inexpensive and easy-to-assemble electric ducted fan jets and their built-in flight stabilization systems make getting started in jets easier than ever. This month's feature, "Life in the Fast Lane," details everything a would-be jet jock needs to know, from choosing a first model to flight tips and more. You, too, could soon experience the thrills of piloting a smooth-flying, high-performance jet. Check it out!

DUMMY ROTARY ENGINE

Have you ever seen a 3D rotary dummy engine that spins? We hadn't, either, and so we had to ask master modeler Brian Perkins to tell us how he made the one in his 1/3-scale Dr-1 triplane. This ultimate scale accessory has lathe-turned cylinders with resin-cast heads, intake manifolds, and rocker assemblies, all mounted on a wood crankcase and covered with a piece of styrene. The painted and detailed "engine" is mounted over a prop extension so that it spins using airflow from the propeller—amazing! Get all the details on page 48.



RC GEEK

This month we're happy to welcome Chris Wolfe and his "RC Geek" column. An accomplished scale modeler who has been named the 2019 U.S. Scale Masters Grand National Champion, Chris's modeling experience isn't limited to serious scale projects. In this issue, he details how he restored a crashed foam warbird to flying condition, reminding modelers everywhere that they don't always need to "trash that crash."



AEROBATICS MADE EASY

Looking for a new move to impress your friends at the flying field? Don't miss John Glezellis's tips on flying the rolling tumble, detailed in "Aerobatics Made Easy" this month. During this complex 3D maneuver, the plane essentially tracks—as if on a string—rolling continuously from one end of the field to the other! Get John's five steps to success, along with his aircraft setup tips, on page 60.



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Convair XFY-1 Pogo | Ettore Quaglia, Persichello, Italy

After designing and building three prototypes in different sizes, Ettore Quaglia presents the "biggest scale RC Pogo on the planet": the 52-inch-long model is made out of fiberglassed foam, carbon fiber, and wood. It uses a custom contra-rotating power system made from two brushless motors spinning two 18 x 8 3-blade Fiala Classic wood props, and powered by a 5,000mAh 6S 40C LiPo. Ettore adds, "My big tail-sitter uses the OpenAeroVTOL stabilization system, and it shares some problems with the full-scale airplane: it can only fly in calm air, it's pretty fast in horizontal flight, and it's very demanding during landings." We say, Bravo!



Fokker Dr. I

Whitney Philbrick, Nolensville, Tennessee

Ron Prestin originally built this 70-inch-span triplane using Scratch-A-Plane plans, and after Whitney bought it, he suffered a midair. Whitney repaired, recovered, and repainted the triplane, added a GTM aluminum cowl with rivet detail and fasteners, and then rebuilt the struts with GTM scale fasteners. It's powered by a Zenoah G38 gas engine.



Astro Hog

Mike Gay, Albuquerque, New Mexico

After building this 36-inch-span model from the BMJR kit, Mike added a GForce E400 motor, APC 8 x 4 prop, and 3S 1300mAh LiPo. With this setup, it can reach speeds of 85 mph and fly for up to seven minutes with some throttle management. Mike adds, "Landing is almost a no-brainer in three-point attitude."

SEND IN YOUR PICTURES! *Model Airplane News* is your magazine, and we encourage reader participation. Email your high-resolution images to MAN@airage.com, with your contact information and details on your project. The "Pilot Project of the Month" winner will receive a *Model Airplane News* digital download of his or her choice.





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F-7F Tigercat

Cliff Becker, Danbury, Connecticut

Cliff flies his FMS 1800mm Tigercat on two 3S 5000mAh packs wired in series to get eight- to nine-minute flights! He adds, "I use quarter flaps for a gentle, scale-like takeoff, and three-quarter flaps for landing on our 300-foot field, and I always have plenty of room to spare. The Tigercat gets the attention of spectators—especially low flybys—and is a very stable aircraft."



B-25J Mitchell

Harry Middleton, Fullerton, California

This all-fiberglass, 81-inch-span model from RC Aerodyne comes with rivets, panel lines, and a lighted instrument panel. Harry opted to up the realism with five 3D-printed pilots, removable machine gun barrels (for transport), and an operational bomb bay. Its bomb release holds 18 3D-printed bombs or three large plastic atomic bombs.



Flying School Bus

Bob McWilliams

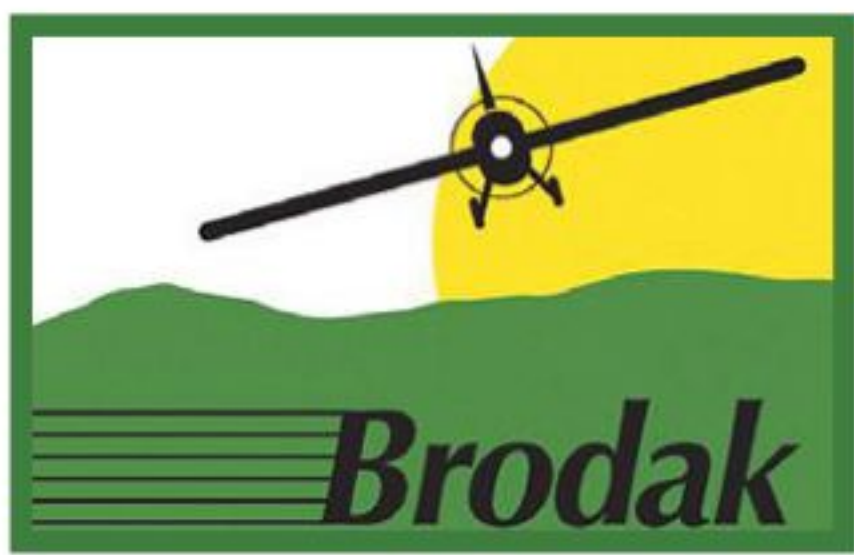
Bob built this "micro," 50-inch-span version of Rumbuilder's Flying School Bus out of blue foam. Powered by twin Park 400 motors, the bus is steered using differential motor thrust. We'll bet it's the star of the show at fun-flies.

Dirty Birdy

Guillermo Robles Echavarria, Medellín, Colombia

Guillermo's new 64-inch-span Dirty Birdy is powered by an O.S. GGT15 15cc gas engine, and has fixed landing gear. He writes, "The maiden flight was perfect; it is a nice pattern airplane." We think this 50-year-old Joe Bridi design hasn't aged a day! ✈





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Rolling Danger

If you've ever been on the receiving end of a hobby knife that's rolled off your workbench, you'll appreciate this easy hack. I wasn't paying attention when my knife, with a sharp freshly replaced blade, rolled off the edge of the workbench and stuck itself squarely into the top of my house shoe-clad foot! After the trauma, I took care of the situation by simply applying adhesive tape to the handle. Fold the tape back onto itself to form a flap. No more rolling foot danger!

Jerry Edwards, Chicago, Illinois



Ready When You Are

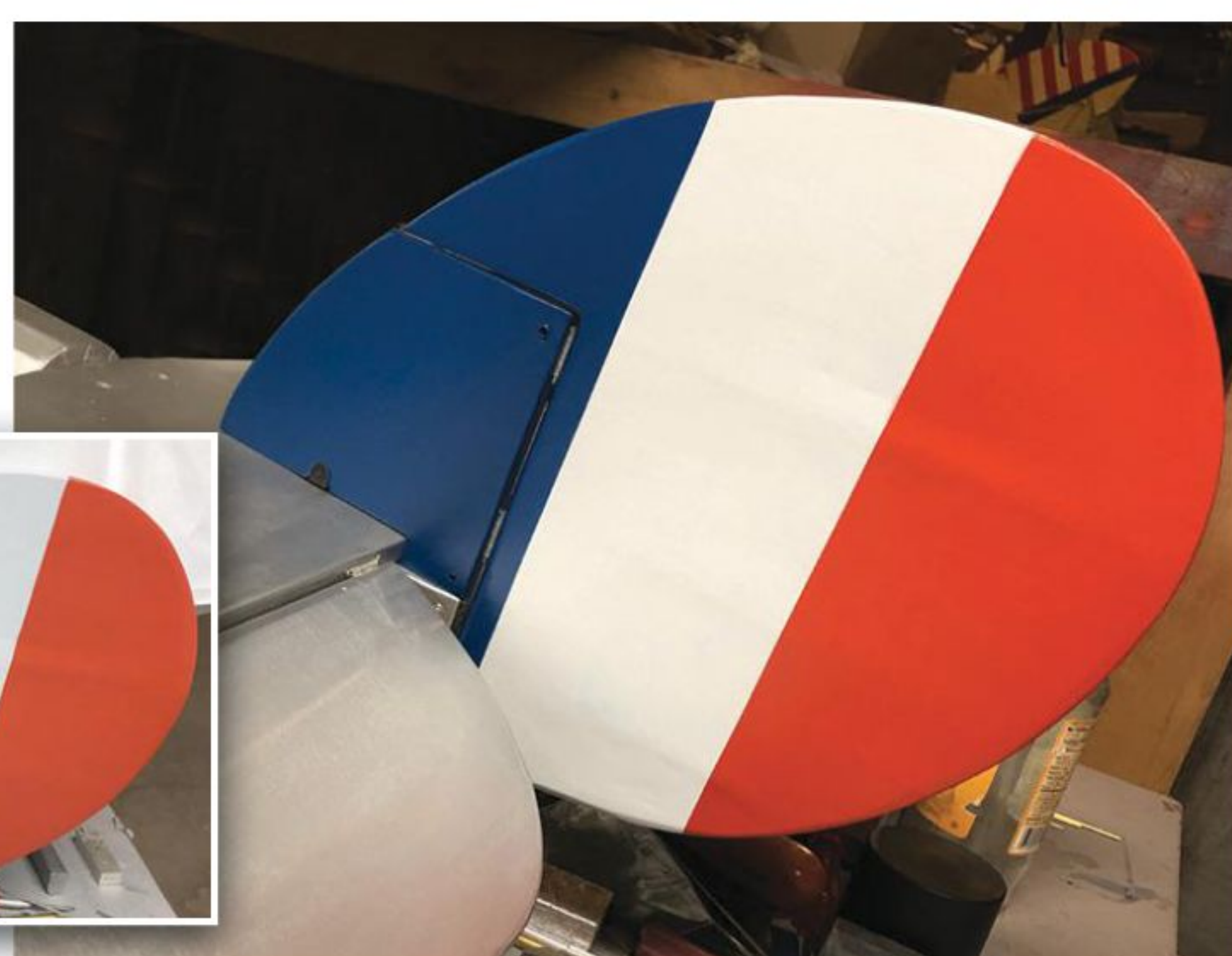
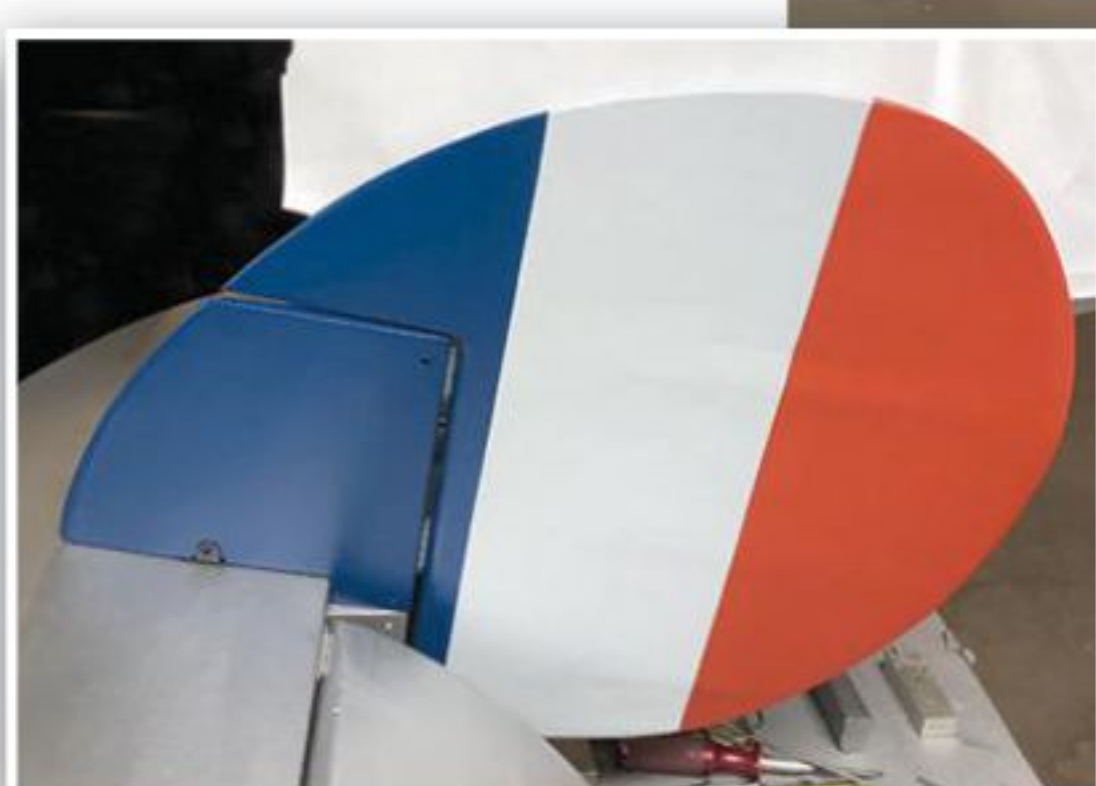
Instead of waiting for your epoxy to get to the nozzle, try this simple solution. The bottles are simply clamped around the neck using large, standard spring clamps. This way the bottles can be placed in different positions (nozzles up at an angle and nozzles down). This setup works especially well if you have a cool workshop and it takes a little while for the epoxy to flow.

William Koster, Lake Havasu City, Arizona

Toned-down White

When it comes to scale RC airplanes, subtlety is what weathering is all about. You don't want your efforts to stand out or look "dirty" as you tone down your paint job. A trick I have been using for years has to do with our perception of color. If you paint a warbird with standard Insignia White, you are then faced with the task of toning it down. What I do instead is replace the brighter Insignia White paint with Juneau White. This is actually a very light gray, but when shown next to other colors, it looks very white. When placed next to a true white (like a piece of printer paper), it shows its true gray color. Give this a try on your next scale airplane. You'll save time and effort on your roundels and rudder markings.

**Gerry Yarrish,
New Milford,
Connecticut**



Credit Card Removal

Most, if not all, electric airplanes use hook-and-loop fasteners to secure the battery packs in place. Often, the fastener holds on so tightly that you have a difficult time removing your pack. Take a plastic credit card and clip it between the fastener halves and then wiggle it so that it separates them. This speeds battery changes while it prevents damage to your battery tray and prevents the fasteners from coming off.

**Michael Frankie,
Boston, Massachusetts**

SEND IN YOUR IDEAS! We want your ideas for Hobby Hacks! This month's winners will receive a *Model Airplane News* digital download of his or her choice. Send high-res digital images, your name and address, and a brief description to MAN@airage.com.



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Irregular Corp. Balsa Model Flight Simulator

Test your engineering abilities with this challenging and detailed model flight simulator that lets you design, build, and fly your own airplanes, and battle other model aircraft. It also features a single-user career mode, where pilots can progress through checkpoint flying, combat, base defense and attack runs, or just solo flying. (Just be careful you don't get your model airplane stuck in a tree!) The physics-based sim even lets pilots build and host their own game sessions for up to 16 players. Check out the trailer at ModelAirplaneNews.com/BalsaModelFlightSim and stay tuned for more details on the summer 2020 release.

theirregularcorporation.com



E-flite P-51D Mustang 1.5m

Scale details, such as guns, removable drop tanks, LED lights, flaps, and sequenced main and tailwheel gear doors make this warbird stand out on the flightline. Available in BNF Basic with Smart (\$499.99), and PNP with Smart (\$459.99) versions, it comes with a brushless motor and Spektrum Avian Smart 100-amp speed control installed, so you just need to add a 6S 3200 to 7000mAh LiPo to achieve flight speeds of more than 80mph and unlimited vertical performance. Its shock-absorbing struts feature ball bearing-equipped wheels with diamond tread tires so it can fly from a variety of surfaces, and its three-piece wing makes it easy to store and transport.

e-fliterc.com



Spektrum Avian Smart ESCs

Ranging from 15 to 100 amps, this new line of speed controls combine "plug-and-play" simplicity with the ability to communicate with other Smart electronics. The programmable units function like a virtual engineer inside your model, providing a one-wire solution for obtaining real-time telemetry data such as current, voltage, cell balance, temperature and rpm. They also have overcurrent low-voltage cutoff, thermal, and failsafe protections. Prices start at \$29.99.

spektrumrc.com



Workshop Sneak Peek: 1907 Antoinette

Master designer Pat Tritle always has a new project in the works, and he shared a photo of his latest design, a 1907 Antoinette for Brodak. He writes, "It's a real oddball for sure, but turned out to be a good little flier anyway. It did take a bit of fiddling to get the Antoinette to fly. The tail—specifically the elevator—is so small, it needed a good bit of positive incidence in the wing in spite of the undercamber!" This RC beauty will soon be available at brodak.com.



FMS 2000mm Beaver V2

A true "pilot's plane," this weekend flier has STOL capabilities and can even do extreme aerobatics! Realistic ailerons and flaps built into the hollowed-out wing structure give the Beaver V2 excellent slow-speed characteristics. It also has landing, navigation, and working strobe lights, and its optional floats and glider hitch add to your flight options. Upgrades from the first version include transparent windows with a cabin interior, ball bearing-equipped wheels, and a servo connector built into the floats. The Beaver V2 costs \$379.99.

fmsmodel.com

Hobby Zone/Arrows RC Bigfoot 1300mm

Everyone loves a tail-dragger, especially if it has flaps, big tundra tires, and can easily take off from just about any patch of grass. Modeled after the famous Texas tail-dragger modification of the popular Cessna 150, the molded-foam Arrows RC plug-and-play Bigfoot will make bush pilots everywhere very happy. We reviewed the Bigfoot in our April 2020 issue and incorrectly listed the distributor as Horizon Hobby. The Bigfoot is available at Hobby Zone (hobbyzone.com). We regret any confusion this may have caused. ✚



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Sneak Peek: DJI Mavic Mini

The everyday flying camera

BY THE *MODEL AIRPLANE NEWS* CREW

When it comes to the world of aerial selfies and personal drones, size is not always relevant to performance. You can now open up your sky with the new, compact yet powerful Mavic Mini. The perfect companion to your creativity, the Mavic Mini captures moments in a way that effortlessly elevates the ordinary. Together with the easy-to-use DJI Fly app, you'll be able to enjoy a simplified flight experience with a point-of-view simplicity beyond any other combination.



Folded up, the Mavic Mini is super compact for easy transportation.

Exceptionally portable and almost as light as a smartphone, the Mavic Mini weighs only 249 grams (8.78 ounces), so it is below the weight that requires FAA drone registration, which is 250 grams (8.82 ounces).

With a satisfying 30-minute flight time, the Mavic Mini includes a 4km HD video transmitter, Vision Sensor + GPS Precision Hover, a 3-axis gimbal, a 2.7K camera, and simplified recording and editing.

The new DJI Fly app offers a simple, intuitive, and very user-friendly control interface, so you'll learn to control and pilot the Mavic Mini quickly. This app allows you to create cinematic shots in short order, and it even features a flight tutorial to help get you started quickly and safely. Mavic Mini has advanced downward-looking sensors, so it can hold its position and hover precisely, even indoors without GPS.

THE APP DOES ALL THE WORK

The DJI Fly app offers a variety of creator templates that you can use to generate awesome videos with just a tap on the touch screen. Even beginners with no editing experience will be able to turn special moments into first-class social media videos. With the QuickShot modes, you have Dronie, Circle, Helix, and Rocket settings. Just select the setting you prefer and Mavic Mini will execute the elaborate preset flight motions while recording. You can then take the automatically generated video and share it with friends on social media.

With its Smooth Motion feature, Mavic Mini's flight speed and movements are slowed down for an added layer of precision and stability. This mode is especially useful when flying in narrow or complex spaces. With the DJI Fly app you also have integrated access to SkyPixel, a social media platform for drone users to share their aerial photos and videos. Browse others' projects, share your own, and even discover popular aerial photography spots in your area.



The Mavic Mini comes with a dedicated controller that works with your smartphone to make a user-friendly and intuitive control interface.



The Mavic Mini drone makes taking aerial selfies as easy as it gets.



■ ON THE FLIGHTLINE: SNEAK PEEK: DJI MAVIC MINI



The four rotor arms/booms swing out and snap into position for flight.

SEE WHAT YOUR MAVIC MINI SEES

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The Fly More Combo package (priced at \$499), includes the Mavic Mini and remote controller, three intelligent flight battery packs, three sets of spare propellers, two micro USB cables, a gimbal protector, RC cables (micro USB, USB-C, and Lightning connectors), a spare pair of control sticks, 18 spare screws and screwdriver. Plus, you get a two-way charging hub, a DJI 18W USB charger, 360-degree propeller guards, and a carrying case. ✚

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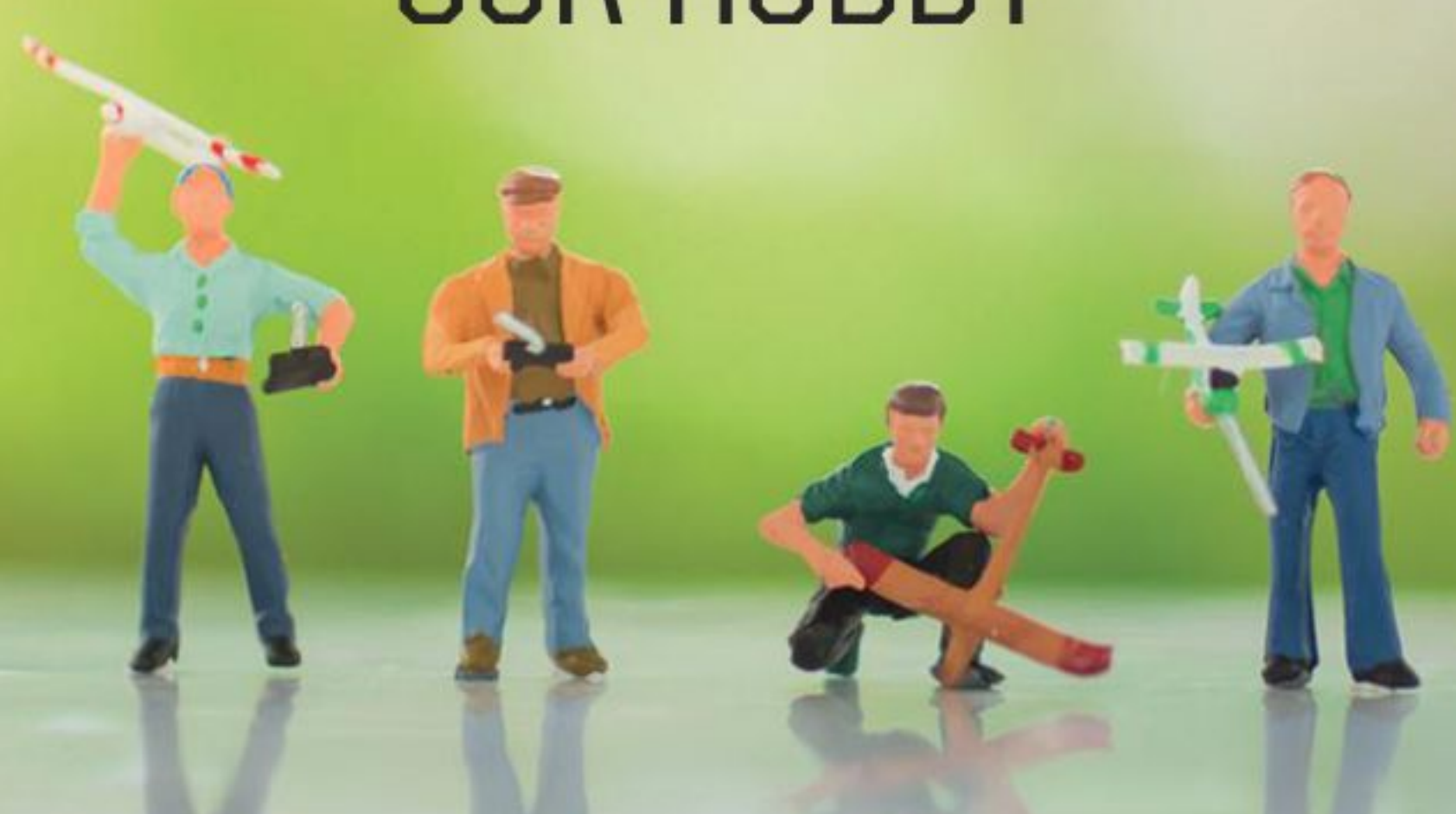


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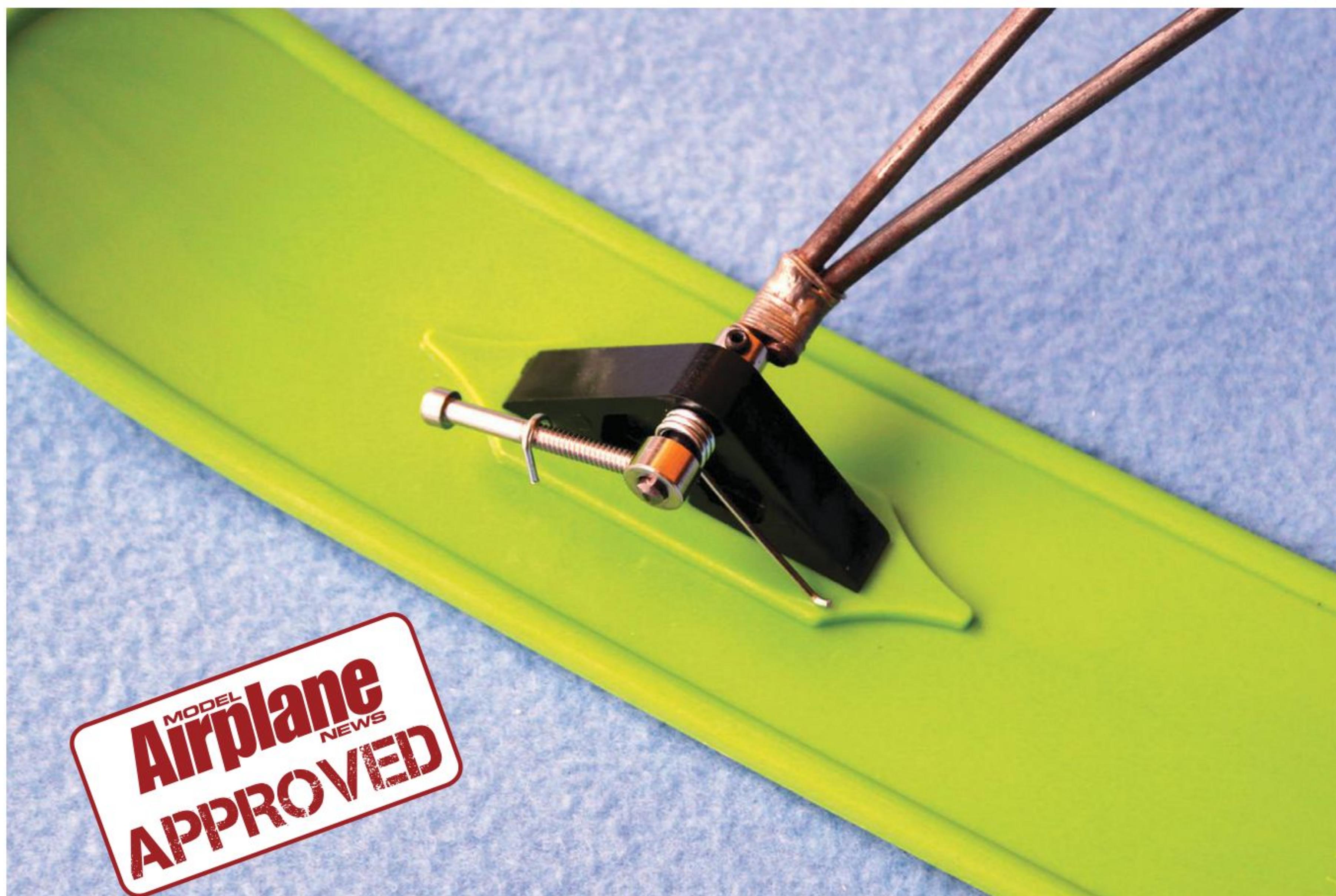
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Du-Bro Snowbird Skis

BY KEN PARK

Up here in Canada, we get our fair share of Old Man Winter, so if you're not out flying in the snow then you are certainly cheating yourself out of some prime air time. I tested the Du-Bro Snowbird Skis on my old standby fun-fly competition model, *Turnbuckle*. It's powered by an O.S. FX .40 2-stroke using a moose can muffler. The oversized ailerons and big tail feathers of this design ensure maximized fun while you're playing all those crazy competition games.



Since the Turnbuckle is a tail-dragger, I only needed to use the main gear set, which costs US\$29.95. (Du-Bro offers an additional US\$15.00 nose gear for those who use tricycle gear.) The skis are made out of tough high-density polyethylene plastic and come in seven hot colors. I tested the .35- to .60-size skis, which are designed for a 5/32-inch axle, which is standard up to and including .60-size models. (Du-Bro also offers skis for electric park fliers for US\$13.95.) The bottom of the skis also features a centerline tracking fin that help keep your model on track in crosswind conditions. Each ski has a spring-loaded wire that allows it to flex upward and then stop at any angle you set it for. Most pilots set that angle upward 5 to 10 degrees in order to avoid catching the tips and getting tripped up on landing. Note that when you fly with the tips slightly up, your model's elevator trim will need some minor adjustment so you can fly hands-off straight and level.

Assembling the skis is easy, and the instructions are broken down into several smaller subassemblies. Clear diagrams take you through the steps of attaching the skis to your model and setting the springs and angles. It takes about five minutes to install them.

The spring-loaded design of these skis is impressively simple and effective once tightened and secured with an Allen key. When locked at the correct upward 5 to 10 degrees, they should provide an entire season of flying without any need for further adjustment. The spring-loaded design totally eliminates the old-school elastic shock cords from the front of the ski up to the fuselage—and that rear string that took forever to adjust to get the proper in-flight angle. Another bonus is that no wax is required with the Du-Bro skis; the hard, smooth plastic doesn't stick to the snow, so the skis slide effortlessly. Don't forget that those seven bright new colors sure let you know just when to flare before touchdown! Put on a set of these new Du-Bro skis and your fun will be guaranteed all winter. ✈

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Sullivan Products S600 Hi-Tork Starter



Though many glow and gas engines today can be started by hand, we always recommend the use of electric starters to keep your fingers free of the propeller. At \$91.99, the Hi-Tork Starter is an excellent choice. The original “standard size” Sullivan starter, it has been a favorite for many years. The Hi-Tork starter is suitable for all sport engines and, as its name suggests, it’s capable of starting engines with much larger capacity. The starter features a sturdy plastic drive cone, a 2 1/2 inch-diameter steel body, and yellow end caps. It comes with automotive-style battery clips and uses 12 volts DC for operation. It has a maximum rating of 80 amps and produces 210 oz.-in. of torque. With a 5,500 no-load rpm, it can be used to start most engines up to .60 cubic inches (10cc), and many 4-strokes in the 1.20 to 1.50 cubic inch displacement range. Replacement starting cones are available separately.—Gerry Yarrish ✦

FIVE TIPS FOR A SAFE START

1

When you set up your model at the flightline, position your starter battery and the power cord so that they are clear of the model’s propeller. If you typically hold the starter with your right hand, make sure the power cord comes straight back and around you.

2

Ask a helper to securely hold the back of your aircraft, both to engage the spinner with your engine starter and to prevent the airplane from moving forward when the engine starts.

3

Always use a fully charged starter battery and make sure that the clips connecting to your battery (or power panel) are properly secured.

4

Hold your starter straight and aligned with the engine’s centerline. If you hold the starter at an angle to the spinner, the cone can “walk off” to one side.

5

Replace worn-out starter cone inserts; worn ones might slip, and if they do, they won’t deliver all the torque produced by the starter motor.

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FEATURE

BY THE MODEL AIRPLANE NEWS CREW

LIFE IN THE FAST LANE

Pro tips for the first time e-jet pilot



This F/A-18 Super Hornet is typical of the kinds of EDF jets available today. It comes with loads of details, functional flaps, and retractable landing gear.



You want to see jets? Today, there are plenty of “jet-ins” held across the country that draw electric-powered jets of all types and sizes.



This really is the best time to get into jet aircraft, especially the electric-powered variety. The latest advances in brushless motor design and LiPo battery technology have been a huge boon to the hobby, and the RC jet set has evolved to take advantage of these performance-increasing benefits. Electric ducted fan (EDF) jets have become one of the most popular sectors in our hobby, and the development of these e-powered speed demons has been nothing short of amazing.

Always, when hobbyists talk about RC jets, the conversation initially focuses on speed. But that's really only part of the e-jet equation. In this article, we cover the basics of power system and airframe setup, showing the various choices and options available to the wannabe jetster! From low-time beginners to advanced RC pilots, there's something for all skill levels. An excellent way to wade into EDF jets is to start with prop jets.

PROP JETS

As the name implies, these jets can look just like full-size jets, but they get their propulsion from electric motors and propellers instead of an internal ducted fan unit. Available as either pusher or tractor jet setups, pusher configurations have the motor and prop mounted in the tail of the fuselage, while tractor prop jets (usually lightweight sheet-foam flyers) have the motor and prop facing the front. Some jets split the difference with the propeller positioned (tractor or pusher) located within the fuselage/wing area in a tight-fitting slot cut into the model.

EDFs

Designers of electric ducted fan jets have developed a few different approaches. These include: fully enclosed or exposed electric ducted fan units, construction type, impeller diameter, and method of inlet air ducting. Regardless of configuration, the heart of the EDF jets is the ducted fan unit. The unit is comprised of the outer shroud or duct; an inlet ring or lip at the front of the duct that smoothly guides the airflow into the duct; a precisely fitting multiblade impeller, which is driven by the electric motor; the hub, which is the central part of the impeller attached to the motor's prop shaft and coupler; and stationary stator vanes that help straighten the swirling airflow produced by the spinning impeller. Some jet designs rely on large openings (aka cheater holes) to draw the air into the EDF unit, while others are equipped with internal air ducting that channels the air into the impellers and the exhaust tube to direct the thrust out of the back of the jet.

Foam construction

Foam is an extremely popular building material for jets. Here, we've included both complex all-molded-foam ARFs and simpler flat-foam-sheet kits you can assemble and glue together. Both have their advantages and they vary in price according to the amount of included hardware and accessories. Foam jets are usually smaller and lighter than

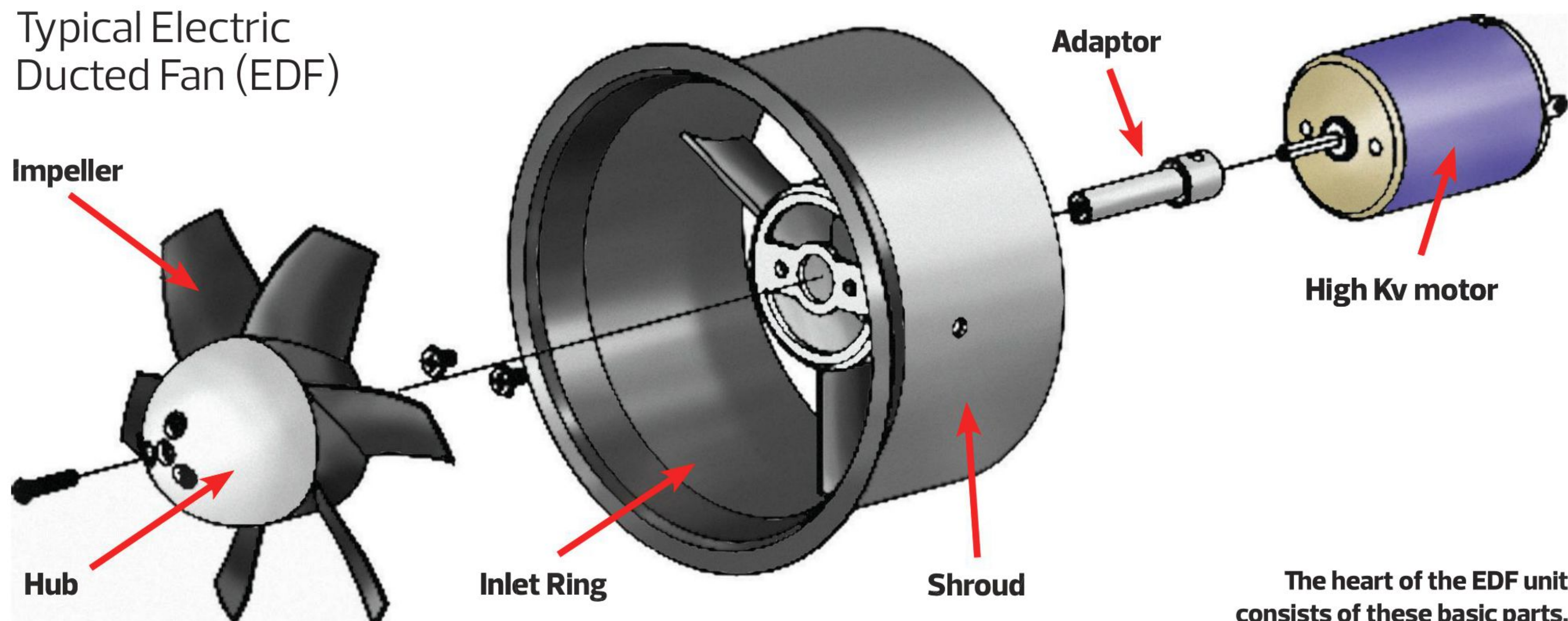


There are all sorts of pusher flying wing designs available, and any of them will make a great transition model on your way to EDF jets; for example, this E-flite UMX F-27 Evolution. It has excellent performance for a relatively small model.



Here, you see the F-27 Evolution's pusher motor and propeller.

Typical Electric Ducted Fan (EDF)



The heart of the EDF unit consists of these basic parts.

built-up wood and fiberglass jets, so they can be powered by smaller, less expensive power systems and can operate with budget servos and radio gear.

Today, there are also some very reasonably priced ARF jets that come with the works: excellent detail, flaps, retracts, and various decal markings. But they do require intermediate piloting skills.

COMPOSITE JETS

A step up from the foamie fliers are the composite/wood designs. These jets come with a molded fiberglass fuselage with built-up wood wing panels and control surfaces. Usually they are already painted and covered, but still require some assembly. The sophistication and complexity of these jets varies greatly, and so do their price tags. There are composite jets available for a few hundred dollars while others are priced at several thousand. Again, it is all a matter of what is included in the box and the quality of the power systems and components used. Size is a factor, as are the control's features. If you want flaps and retractable landing gear included you'll pay more, but you'll also enjoy increased performance.

PROPER CONTROL

A very important point to consider is the quality of your radio gear. The lighter and simpler your model is, the less expensive and powerful your servos need to be. As the weight and speed of your jet increases, the flight loads and demands on your servos also increase. Ten dollar mini servos are just fine for small, low-speed prop jets and EDFs. But for the mid- to upper-end jet range you should use more powerful servos that range from 40 to 60 oz.-in. of torque. Also, with increased speeds, servo centering and precision becomes more important too. As with everything else in the RC world, that additional speed costs more.

PILOT TRAINING

Flying exciting EDFs, like the FMS F-18 Super Hornet or even the BVM Electra, can be exhilarating but not especially difficult. This is where you have to evaluate your own piloting skills. If you're a relatively new pilot, you should first learn to fly normal prop-driven airplanes and get comfortable with flying faster and faster. Low-wing, aileron-equipped, high-performance sport planes are great for pilot training. You can also practice using a flight sim program. Then, when you are really comfortable with speed, move up to something sleeker with less drag, such as a pusher flying wing. There are several of this type of prop jet to choose from, including the E-flite UMX F-27 Evolution. Flying wings with their reduced drag and increased speed are extremely well-suited for pilot training. Once you are comfortable flying them, you'll be ready for jets.

THE BUNGEE LAUNCH



Expert model designer Nick Zirola Sr. built his Turbinator-E (a smaller e-powered version of his larger turbine jet) so that it can be easily bungee launched.

There is a gray area in model jet size, where some models are a little too big for a comfortable hand-launch, but not quite big enough for a set of landing gear for a "rise-of-ground" takeoff. Here, we can borrow from the glider pilots and adopt bungee launch systems: nothing more than a length of surgical tubing, a stake, a ring, and some nylon cord— the bungee launch is the best compromise.

For your average four- to five-pound EDF, a 30- to 40-foot length of 3/16- to 1/4-inch diameter surgical tubing will do nicely. A 12-inch tent stake driven into the ground anchors one end and a tow ring is tied to the other so it can be attached to the launch hook. For a smooth launch, the hook should be an inch or two forward of the plane's CG. The longer the bungee, the better; you want a constant, smooth pull for a longer time. Shorter lengths produce more aggressive pulls but they are shorter in duration.

How much pull? A good way to fine-tune your launch system is to use a fish scale and pull the launch cord back so it shows a force four or five times the weight of your model. For example, for a four-pound jet, that would be 16 to 20 pounds. Hold the model low with its tail just touching the ground and its nose pointed up just slightly. Have your flying buddy secure the plane and when you're ready, have him release it. Have a little up-trim dialed in and concentrate on keeping the wings level. The upward departure flight path angle should be shallow until you have gained sufficient airspeed for your first turn.—By Nick Zirola Sr.



No landing gear means less weight and drag, which equates to more performance.

FLIGHT CONTROL

Another difference between flying jets and standard RC airplanes is that jets don't have prop blast directing airflow over the wing and control surfaces. Pilots of conventional airplanes get accustomed to the almost instant thrust and increased control response created by simply punching the throttle. The propeller both propels the airplane forward and blankets the control surfaces with plenty of airflow. A jet, on the other hand, needs smooth airflow into the EDF unit to produce thrust. Sharp, abrupt maneuvers can interrupt and reduce this airflow, leading to less thrust and reduced speed. When there is no increased airflow, what control you do have

all depends on maintaining airspeed. This is not difficult to master, but it is something to keep in the back of your mind if you're considering low and slow hot-dogging with your jet.

FLIGHT OPS

One thing the new "speed freak" may overlook before buying that first jet is evaluating the condition of the home base of operations: What's your flying field like? Is it a well-manicured sod field with a pool table-smooth surface? Do you have a paved runway? Or, is it the local soccer field? If you are flying off of shaggy grass, it would be best to fly smaller, hand-launched foamie jets. Typically, the wheels

SIZE RANGE



Longtime contributor and RC jet expert Rich Uravitch shows off one of his many jet designs, the Sub-Sonex. It can be powered by either an EDF unit or a small turbine engine.

Today, in the world of RC jet modeling, electric propulsion systems are very reliable and easy to operate, and their performance output is remarkable. Here's a snapshot of the evolution of the sizes (diameters) of electric ducted fans.

The 70 mm (2.76 in.) jets are the least expensive and are typically powered by smaller 3S and 4S (11.1 to 14.8V) LiPo battery packs. Owing to the large number of sources, this is the most popular size. Most jets in this category are made of molded foam, and usually come with servos, fan units, and control linkages already installed, making them truly almost-ready-to-fly (ARF) models.

Stepping up in size to 80 to 110 mm (3.1 to 4.33 in.), the expense does increase somewhat, but it also introduces a fair number of jets featuring molded fiberglass components and balsa-sheeted wings. The overwhelming number of products here are ARF with molded foam structures, but they are more rugged, frequently employing carbon fiber reinforcement. The advantages here are more durability, better flight performance, and larger equipment-installation areas so components aren't shoehorned into place. Batteries required for this class usually fall into the 4S to 8S category, depending on your choice of motor and ESC.

One distinct advantage to the molded foam airframe design is that the inlet ducting is molded

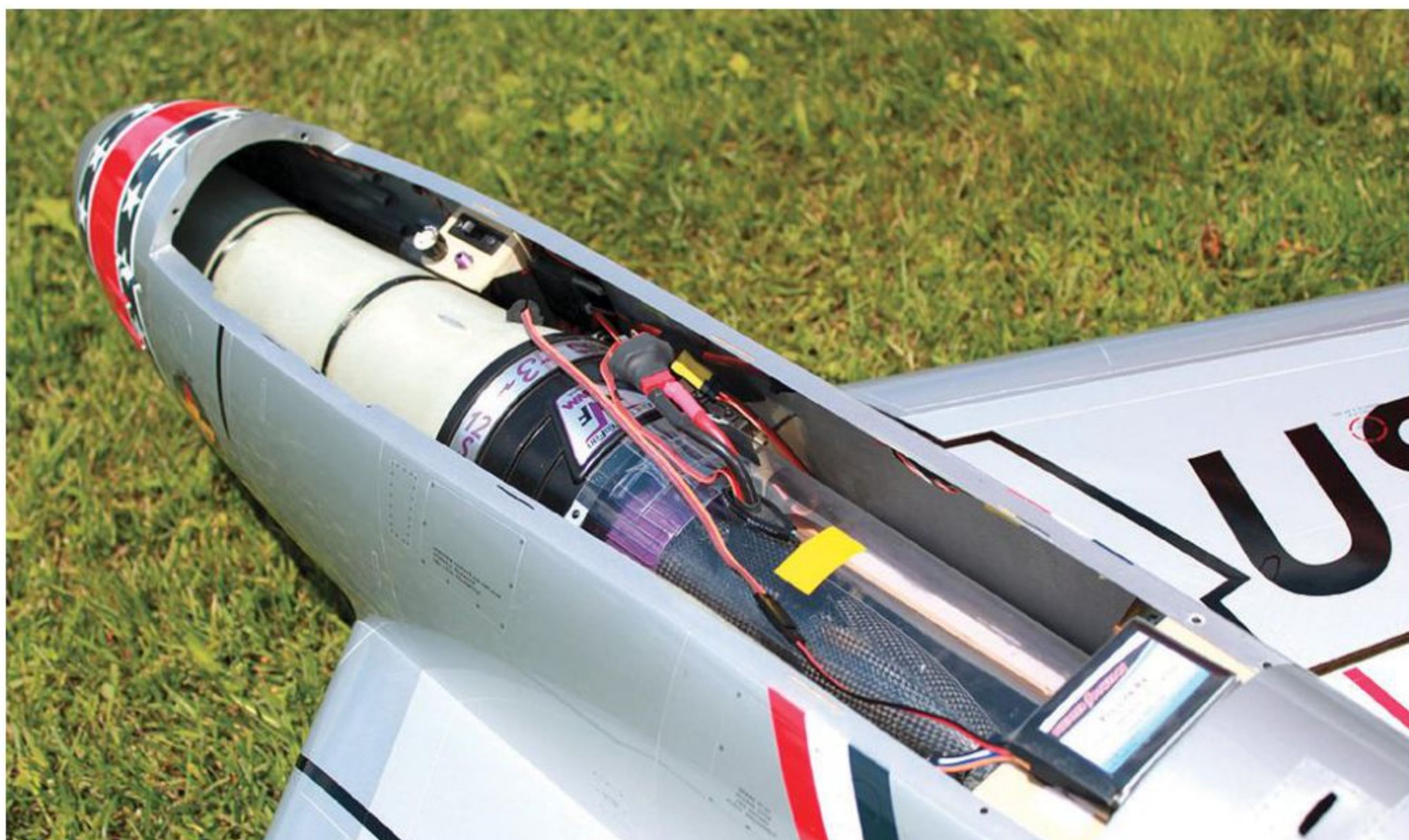
as part of the fabrication process. This is a great feature, since properly designed inlets and exhaust ducting are critical to good fan performance. Unlike turbine jets, EDFs are air movers that depend heavily on the smooth airflow, both coming into the inlets and going out the tailpipe.

Also, increased wing loading makes flaps even more important, especially during landings. Flaps are a great benefit, and you should practice using them to improve your piloting skills.

Going up yet another notch puts you in the 120 mm (4.72 in.) and larger fan group. Generally operating with 10S to 12S packs (37 to 44 volts), they generate extraordinary power—they really demand respect and attention to detail. Understandably, the components that fit into this group are the most expensive. This increased performance demands proper assembly and maintenance. Don't use questionable servos, radios, or battery packs that might be marginal in performance or otherwise seem suspect.—By Rich Uravitch



The Electra from BVM is at the top of the performance class.



With the main hatch removed, you can see the basic power system layout for this BVM F-86 Sabre jet—uncomplicated and very efficient.



Battery packs are also very important. LiPo batteries are available in several cell counts and capacities. Be sure to match your pack to your jet's requirements.



Electric ducted fans come in all shapes and sizes. There's an EDF unit for jets of every size.



Matching servo speed and torque values to the size of the jet you fly is essential. Don't skimp here!

on jet landing gear are smaller than your average RC sport plane, and some won't even roll in tall grass. Skip the landing gear and give it a toss. For more advanced jets, you'll need a smooth runway—and if you have retracts, the smoother, the better. When you travel to e-jet events, most are hosted by clubs that have access to smooth tarmac for effortless takeoffs and landings regardless of wheel diameter. So evaluate your own situation and fly something appropriate.

SMOOTH MOVES

Flying at high speed is a thrill for all pilots. But things happen quickly with jets and they can become very small in a heartbeat if you just fly in a straight line away from yourself. The best jet pilots fly with a flight plan and stick to their plan until they land. It can be very easy to mentally fall behind a fast jet, so have a simple mission; don't just bore holes in the sky. If it's a first flight, concentrate in trimming your model for straight and level, and then fly around the pattern at a safe altitude and at different speeds to see how the model reacts. If you have some time on your jet, then practice your landing approaches and being smooth with your control inputs.

For more advanced jets, practice flying with the flaps and landing gear up and down, and consider using flight modes with your computer radio. Have one setting for takeoffs, one for general flying, and a third to set up your model's landing configuration. When it comes to turning around, use large, smooth, sweeping turns to keep your model in the groove and to maintain airspeed.

Vertical moves are popular maneuvers for turning around and reversing directions without going out too far. At the end of a horizontal speed run pull into a steep vertical line, do a half-roll and then pull into a partial loop to come back down and establish straight and level flight going the opposite direction. To swap directions again, while gaining altitude do a half-loop and at the top do a half-roll back into level flight.

E-JET SOURCES

Advantage Hobby (advantagehobby.com)

Bob Violett Models (bvmjets.com)

E-flite (eflite-rc.com)

FMS (fmsmodel.com)

Freewing Model (freewing-model.com)

Horizon Hobby (horizonhobby.com)

Motion RC (motionrc.com)

Jet Hangar Hobbies, Inc. (jethangar.com)

Schuebeler Technologies (schuebeler-jets.com)

WeMoTec (wemotec.com)

BOTTOM LINE

Once you decide to join the jetsters, get ready for some extreme fun and excitement in the fast lane. These basic tips will help you stay ahead of the learning curve while avoiding basic beginner mistakes. Electric jets are a perfect way to feed that need for speed! Go ballistic! ✈

TEXT & PHOTOS BY RICH URAVITCH

E-flite/Horizon Hobby

F-16 FALCON 64 MM

Great flying electric model of a world-renowned jet!

Whether you call it Fighting Falcon, Viper, or “the Electric Jet” (as it was originally known), the F-16 should need no introduction. When it comes to sexy-looking modern jets, the F-16 has to be near the top of the list. Not at all angular, faceted and stealthy like the F-22 or F-35, it has a slippery shape from nose to tail with a tall, 360-viz canopy that maintains those sleek lines. These all contribute to the illusion of rapid forward motion, even while it is static on the ramp. It is also the ride of choice for the current U.S. Air Force Demonstration team, the Thunderbirds. Their slick red, white, and blue unique scheme has been seen by thousands, if not millions, of spectators around the world.

Many of the qualities of the full scale make it nearly ideal for a jet model subject, a fact that many manufacturers have recognized: the Falcon is available in nearly every size, from micro EDF right up through “monster” turbine-powered replicas. This model is ideally suited to the role of a first performance electric ducted fan (EDF) for the newcomer. It is “right” sized using a 64 mm EDF unit and easily fits into the average



The color scheme chosen for this model is bright, attractive, and highly visible! And it's scale to boot!



HITS

- + Great-looking scale appearance
- + Excellent flight performance
- + Easy to transport
- + AS3X flight stabilization

MISSES

- + Molded-in hinges (in my experience these tend to fail over time)

AT A GLANCE



MODEL

F-16 Falcon 64 mm



MANUFACTURER

E-flite (e-fliterc.com)



DISTRIBUTOR

Horizon Hobby (horizonhobby.com)



TYPE

Sport-scale electric ducted fan jet



WINGSPAN

28.7 in.



PILOT SKILL LEVEL

Intermediate



ASSEMBLY TIME

45 min.



RADIO REQ'D

5-channel DSMX/DSM2 compatible



POWER REQ'D

3 or 4S 2200mAh LiPo



PRICE

\$179.99 (BNF Basic); \$159.99 (PNP)





Aft section shows the stabilizer, elevator, and fin installations. Control linkages are short and straight, providing positive control.



Battery compartment with canopy hatch removed. I used a Smart Technology 4S 2200mAh pack and the pre-installed Spektrum AR636B receiver.



Canopy hatch fits snugly and is magnetically secured.



Upper aft fuselage prior to vertical fin installation. I used 15-minute epoxy on all foam-to-foam applications.

car, fully assembled. It also delivers great performance enhanced by the inclusion of E-flite's SAFE Select recovery and A3SX stabilization systems. (That's in the BNF Basic version I reviewed. A plug and play version is also available). These all add up to give the newbie a better chance of becoming familiar and comfortable with EDF models.

UNIQUE FEATURES

This E-flite model is an accurate rendition of the full-scale jet. It features molded, predecorated EPO foam airframe components that require minimum assembly. Made from this vastly superior material, the quality of this new generation of models just keeps getting better and better—light years ahead of first-generation foams. The protective packaging is also outstanding, with more-than-adequate protection provided for the major components.

Right out of the box, the components are impressive. The color and trim scheme, which mimics a full-scale F-16 attached to the 149th Fighter Wing of the Texas Air Guard, is accomplished with a combination of paint and factory-applied thin transfers that nicely hug the surface contours. The scheme itself is scale and very attractive, but I expect the model will see some other interesting and exotic paint jobs by the "makeover" crowd! The two wing panels are secured with four screws and are reinforced with a rigid tube that goes through the fuselage.

A good-looking set of external stores (tanks and missiles) is included and they really dress up the model considerably. They are all to be permanently glued into place at the correct location; no means is provided to make them removable (such as magnets). I would suggest using the magnet method to make them removable, as they are vulnerable,

especially if you fly off grass surfaces. The large external fuel tanks seem to blank out a bit of the elevator effectiveness, especially on the approach; it's nothing serious, but something to be aware of.

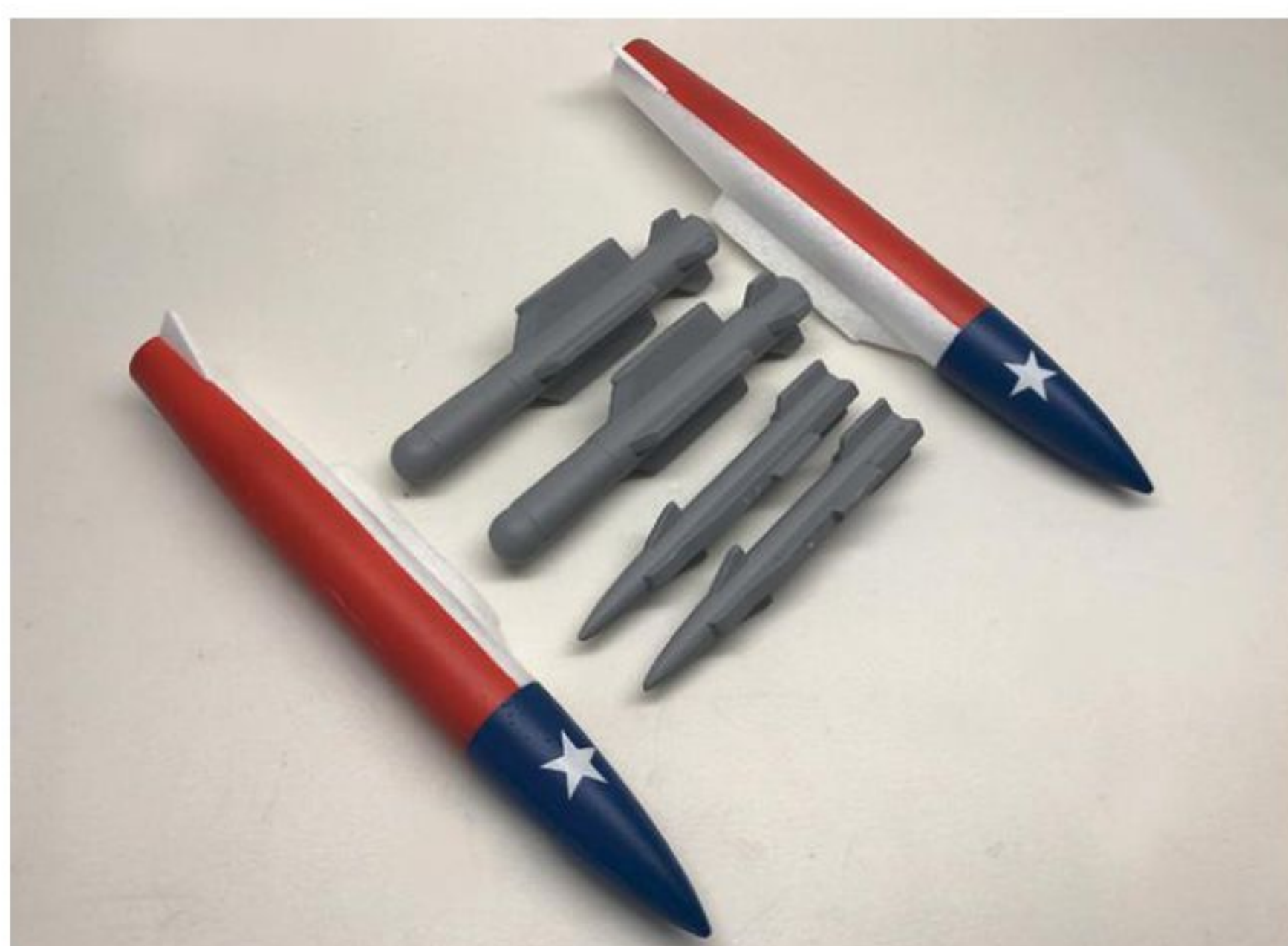
Now, let's talk about a few things I found that you should know about if you are a relative newcomer to this type of model and are considering building one of your own. In my opinion, a great deal of thought went into the actual design of the airframe and the component integration, such as the inlet ducting, fan placement, and hatch attachment. It's a great flying model without the typical shrill, high-pitched sound we've come to expect from traditional low blade-count rotors (five or six). Eleven blades do the trick here, quieting things down and actually creating a sound more like a turbine than a dog whistle! The model employs the 64 mm E-flite fan unit driven by a 2840 Kv brushless motor. Coupled to a 4S LiPo feeding through a 40A speed controller, this unit delivers some really sparkling performance in the model. Having no rudders, it is basically a 3-channel and is easy to fly.

The included assembly manual is clearly illustrated and comprehensive. It has all the instructions you will need to assemble and set up your model, including details on how to set up the SAFE function and A3SX stabilization system.

If there is one thing I don't care for, and this seems standard across the smaller foam E-flite offerings, it's the molded-in hinges on the control surfaces. Although they work just fine, and are esthetically pleasing, I have had some failures after a time for a variety of different reasons. None of them were catastrophic, just annoying. They were all resolved by applying tape along the hinge line.

IN THE AIR

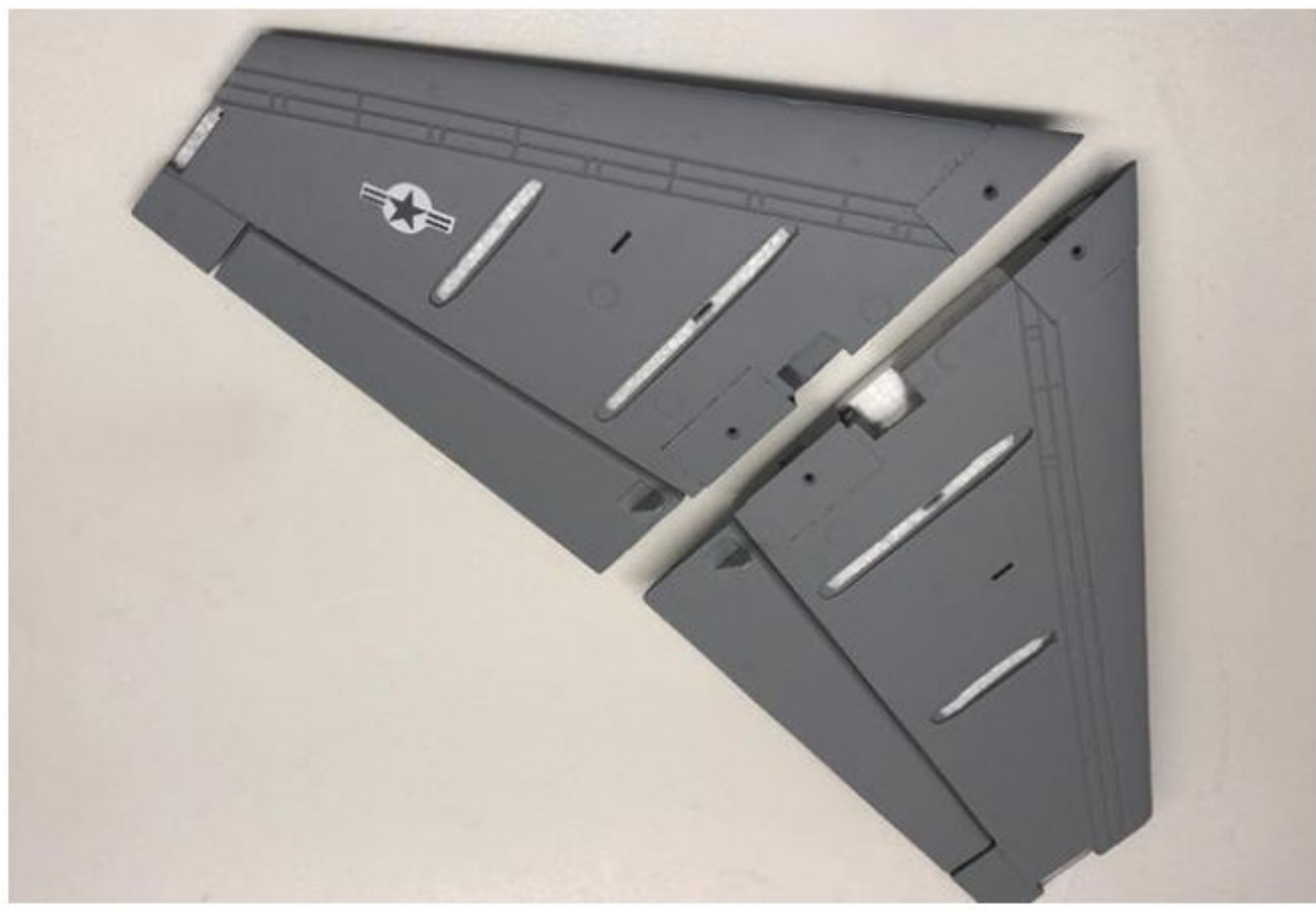
I set my transmitter timer to three



Good-looking external stores package really dresses up the model. Consider making them removable for flight.



Left-hand side shows pre-installed mini servos for aileron and elevator surfaces.



Lower surfaces of wing panels. Unpainted areas show location of tanks, bombs, and missiles.



Horizontal stabilizer/elevator assemblies prior to attachment to fuselage. They have molded-in hinges.



Bottom view showing aileron and elevator servos, ventral fins, and aux inlet for fan unit. Landing gear is easily removable.

minutes, which provides enough energy for some aggressive, high-throttle flying mixed with reduced-throttle cruising, and then land with 25 to 30 percent capacity remaining.

The fixed tricycle gear is quickly and easily removed to create the illusion of retracts. Since the model is not difficult to hand launch, this becomes a convenient option, depending on the type of surface you are flying from. The nose gear, when installed, is steerable. There is no coupled rudder control.

On takeoff and landing, the model can become a little skittish on the ground due to the narrow track of the main gear. In little or no wind, this should not be a problem. A little crosswind combined with the right amount of speed, however, could result in a "wheelbarrow," causing the nose and either tip missile to strike the runway.

Stability: The proportions of the Viper hint that it's going to be very stable—and it is. I balanced my model three inches behind the wing/fuselage intersection at the root, and that seems to be a sweet spot.

Tracking: The model tracks true throughout nearly all maneuvers. Given that it's a prebuilt, molded-foam ARF, the likelihood of warps is minimized and it shows, displaying very predictable flying qualities.

Aerobatics: The Falcon easily performs any scale-type aerobatic maneuver you would expect of a scale jet model of this type. A big plus is the level of power provided by the propulsion system; it doesn't require building up a huge head of steam to get over the top in big, round loops and moves the model along at very scale-like speeds. Rolls are smooth and fairly

axial, and the ailerons, even in low rate, are effective. Almost no elevator is required through the revolution.

Glide and Stall: It is very good in the slow, nose high (high alpha) regime and is remarkably stable, especially on approach.

PILOT DEBRIEFING

Although Horizon makes no claims as to speed potential, I will say that for its size, when it is "on the step" it really appears (and sounds as if) it's moving briskly, and that's good enough for me! Remember, perception is reality. Once you apply power, hold on, because after the nose gets light, steering goes away and you've got no rudders to correct the heading. But, with the thrust available, you are probably already climbing out!

GEAR USED



RADIO

Spektrum DX6 2.4 transmitter, AR636B receiver (installed on BNF version), 5 mini servos (installed)



POWER:

E-flite 64 mm EDF unit with 2840 Kv brushless outrunner motor and 40A speed controller w/ BEC (installed)



BATTERY

Spektrum Smart Technology 4S 2200mAh LiPo



From any angle, the E-flite F-16 64 mm Falcon looks great and, even better, it's a super flier!

BOTTOM LINE

You can plan on spending less than an hour assembling your Falcon, as there really isn't that much to "build." Four screws secure the two wing panels, and I used 15-minute epoxy to attach the vertical fin, horizontal stabilizers, and ventral fins. I would suggest that the ventral fins be attached by magnets or left off completely as they are quite vulnerable in many landings, especially if you opt for leaving the landing gear in the box.

Some experience with EDF-powered models will be helpful, but is not necessary. Actual assembly is straightforward and does not require a lot in the way of tools other than a screwdriver. This little jet flies remarkably well, scale-like, and is very fast on the stock power system. It is relatively unaffected by moderate wind conditions (especially if the A3SX system is active) and doesn't hold any surprises. It is likely to become one of your favorite "throw it in the car with extra LiPos" sport-scale jets and is a step up from nearly all of the small EDF foamies, both in sophistication and performance.

Having no rudders, it is basically a 3-channel bird that is easy to fly, not intimidating to the newcomer and, when coupled to the SAFE Select system along with the pre-installed Spektrum AR636 receiver with A3SX, takes much of the "pucker factor" out of transitioning to EDF jets. Even if you are already "jet qualified," the little F-16 would be a great addition to your EDF hangar. Although the model would probably fly on a 3S (11.1V) pack, why bother? Stick with the 4S. It's a jet and should perform like one, right? ✈

FEATURE

TEXT & PHOTOS BY BILL MCIVOR

WINTER FLYING

A cure for the wintertime blues

Instead of sitting on the couch watching television and waiting for spring to arrive, why not build or buy a set of snow skis, bolt them to your plane, and get out there and do some cold weather flying! Winter flying is great fun, and it restores the RC soul during those long, dreary winter months. You can fly with skis, or even use floats, from almost any open field. Just be sure to get the permission of the property owner. You can also fly from a frozen lake (but make sure the ice is safe and that you have enough room to operate your plane properly). Remember, when flying from a lake you'll be sharing the space with snowmobilers, ice fishers, and other wintertime sports fans. Simply be respectful of others, and you will most likely gain a happy audience.



Bill McIvor's Sky Wizard on Rice Lake on a fantastic sunny day.

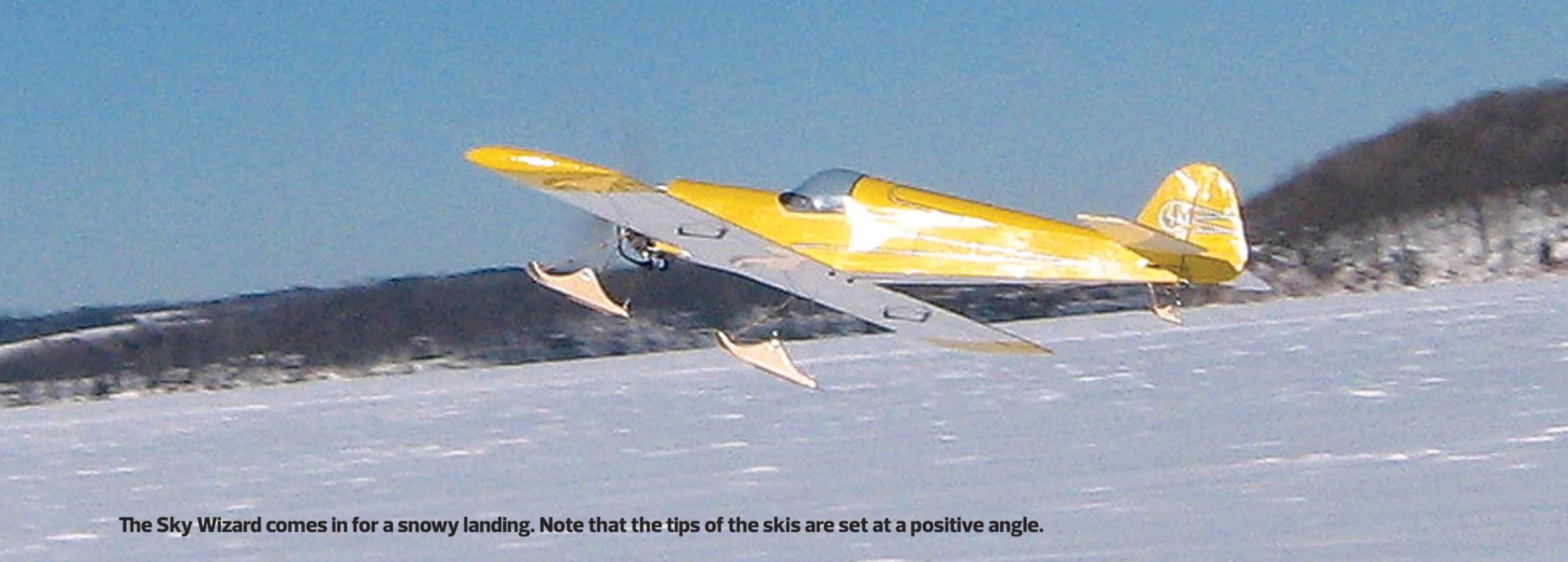
GETTING IN THE MOOD

Dressing warmly is most important for enjoying a day's flying in the winter. It is even better if you can park your car near your flying spot or find a flying area near a shelter to warm up every so often between flights. A thermos full of hot coffee or soup is a must-have for between-flights enjoyment! If you're lucky, you'll find that some winter days can be simply outstanding. With little or no wind, bright sunshine, and milder temps, you won't even need to wear gloves while preparing your aircraft. For flying, I use a tight-fitting pair of cotton gloves, which allows me to feel my radio's control sticks. Mechanics' gloves also work well.

Though I've never used them, there are commercial transmitter gloves you can purchase. Similar to Hippo Hands used by motorcyclists, these cold weather radio

gloves have a clear panel so you can see your transmitter while your hands are protected from the elements. From my own experience, during the winter months there are many fine days just perfect for flying. The advantage of flying off a lake or a wide open field is that you can always take off directly into the wind, no matter what the direction is. My friends and I have a favorite spot to enjoy cold weather RC flying. Located in the village of Gores Landing, Ontario, Rice Lake is renowned for its fishing in both summer and winter. There's plenty of room and the scenic panorama is inspiring.

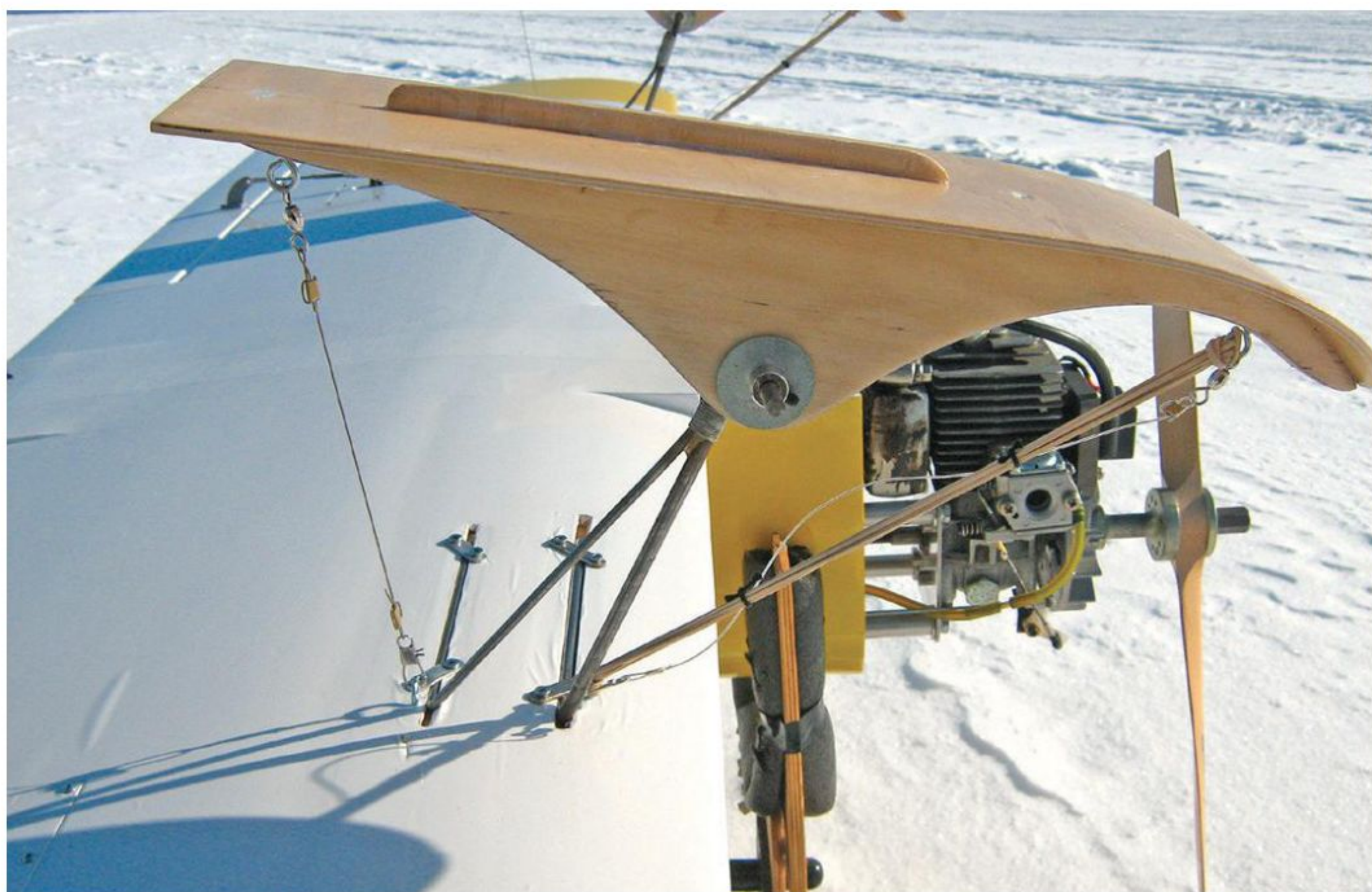
In the winter, I fly my Aeromaster biplane (with floats), and my scratch-designed and built Sky Wizard. The aircraft seen in the pictures is my Sky Wizard, which is an easy-to-fly intermediate to advanced sport plane powered by a Zenoah G-38 gas engine.



The Sky Wizard comes in for a snowy landing. Note that the tips of the skis are set at a positive angle.



The Ace Extreme RC Transmitter Glove is made for very cold flying days. Check them out at acewingcarrier.com.



Here is my scratch-built plywood skis and the limiter cable setup.



The tailwheel ski also uses limiter cables.

EQUIPMENT SETUP

You can find commercially available RC skis online and in hobby shops. Du-Bro has them in a few sizes. I scratch built and designed the skis for my aircraft. I use a tried-and-true method of setting up skis on aircraft that is not unlike that of full-scale aircraft. Check wires and bungees (elastics bands for models) are used to limit the amount of travel the skis have up and down. The elastics are used to keep the tips of the skis in the "up" position, while the check wire at the back limits the amount of distance the ski tips can travel up. The check wires on the front tips of the skis also limit the amount of travel the skis can go down. This is essential to prevent the ski from traveling down so far that it could break through ruts and divots your aircraft might encounter during its takeoff run or landing rollout. It is a very simple and effective way to set up your skis with a minimal amount of funds.

WHAT YOU'LL NEED

- Small eyehook screws
- Elastic bands
- Strong wire (I used pull-pull cable purchased at my local hobby store)
- Short lengths of 1/8-inch diameter copper tubes for crimping the wire ends.
- 1/2-inch, 1/8-inch, and 1/16-inch plywood for upright mounts and ski bottoms. I go a step further and use fishing swivel leads for ease of removal. The skis are built using 1/2-inch aircraft ply for the upright mounts and 1/8-inch plywood for the ski bottoms. It is important to have runners on the bottom of the skis to help the aircraft's tracking. For the tail ski, I use 1/8-inch plywood for the upright and 1/16-inch aircraft ply for the ski bottoms. Another system used to limit the up-down travel of the skis is the torsion rod system or spring system. This is found on Du-Bro and other brands of skis. I prefer my setup described above for its reliability. It has always worked for me.

10 Easy Steps for Cold Weather Engine Starts



To commit RC aviation, you have to get your engine running. As the weather turns colder, it's a good time to revisit cold-engine starting techniques. Here are 10 easy steps for flying when the temperature drops.

1. Turn on your transmitter and receiver.
2. Fully open the throttle.
3. Watch for fuel in the line and cover the throttle opening with your finger. Firmly grip the propeller, and rotate it until the fuel is just up to the carb. Don't flip it! Now turn the prop over—twice, if it's warmer than 40 degrees F; three times if it's colder—to prime the engine.
4. With the glow plug disconnected, flip the engine over six to eight times.
5. Close the throttle and move the trim to fully up. This should open the throttle barrel a little more. The throttle should be about one quarter open.
6. Grab the prop firmly, and rotate the engine until it passes through the compression part of the stroke. You should feel the engine kick. If it does, it will now start on the first or second flip. Always use a chicken stick or electric starter for starting. If the engine doesn't start, flip the prop a few times with the glow plug disconnected, and try again. If it doesn't kick now, choke it one more time with the throttle fully open, flip the prop a few more times, reposition the throttle, light the glow plug, and try again.
7. If, when your engine starts, it just revs up and

quits, turn the high-speed needle valve a half turn counterclockwise to open it, and try again. Repeat this if necessary.

8. If the engine starts, slows down and quits, and if a lot of smoke comes out of the exhaust, turn the high-speed needle valve clockwise to make the mixture leaner, a quarter turn at a time. Restart the engine.

9. When the engine has started, hold the throttle partially open, and let the engine warm up for at least a minute or two before making the final adjustments.

10. Most engines are harder to start when they're hot. To start a hot engine, draw the fuel up to the carb, but don't choke or prime it. Open the throttle to one quarter. Flip the prop hard. Use an electric starter, if you have one available.



Getting your engine started in winter isn't difficult as long as you have fresh batteries in your glow driver and you keep your airplane and engine warm in the car between flights.

BOTTOM LINE

I think what I like most about ski flying is the added performance of the aircraft due to the denser cold air. I also enjoy watching the way the skis work during takeoffs and landings. With all the beautiful winter scenery, and the extra time spent with my like-minded friends, there is really nothing better! ✚

VQ Warbirds **RARE BEAR**

Sporty Reno Racing superstar

Today, we see a lot of the same ARFs at the flying field. Yes, there are times when something new and different shows up, and that's thrilling, but in today's less-time-to-build world, it's all the more refreshing to see something exciting. I am always on the lookout for unique and outright cool ARFs, and the impressive Reno Racer Rare Bear from VQ Warbirds is just that type of plane. I've always liked the Grumman Bearcat, but not its basic, Navy blue paint job. So when I discovered the Rare Bear, it really caught my attention. A fun scale plane of a popular warbird turned racer, this version is not often modeled. The gang at VQ Warbirds picked the beautiful orange and purple version of the racer, and does that ever light up in the sky! It doesn't require a lot of time to build and it comes with that impressive color scheme straight out of the box. Let's take a closer look.



Down the runway on a high-speed pass, the Rare Bear is an exciting plane to fly.



Moment of truth! The EME 60cc gas engine easily starts up for the first flight.

HITS

- + Ease of assembly
- + Matching colors
- + Correct fit
- + Flying characteristics

MISSES

- + The big spinner hides engine details

AT A GLANCE

	MODEL Rare Bear
	MANUFACTURER VQ Warbirds (vqwarbirds.com)
	TYPE Sport scale Reno Racer
	WINGSPAN 80 in.
	PILOT SKILL LEVEL Intermediate
	ASSEMBLY TIME 8 to 12 hours
	RADIO REQ'D 6-Channel (with 8 servos)
	POWER REQ'D 30cc-60cc
	PRICE \$549.95



Here is the EME 60cc engine I used to power the Rare Bear.



The aileron and flap servos are installed under flush-fitting hatches on the underside of the wing panels.

UNIQUE FEATURES

I was taken by the colorful design and the accuracy of the model. What pleasantly surprised me was how closely the fiberglass parts, like the cowling, match the rest of the plane. Also, the panel lines on the wings and hatches complement the plane's detailed appearance. I was happy to see the flush-fitting hatches for the aileron and the flap servos. Even the inside of the wheel wells are finished in light Aircraft Gray. Again, it's a small detail, but it looks so much better than bare balsa wood. I love the convenience of being able to remove the large cockpit hatch and have all the switches installed on the inside. This keeps the airplane clean and more scale looking. The cockpit comes with the pilot already installed, and a good-looking instrument panel is included.

The wings slide into place with two metal wing spar tubes set into recesses on each side of the fuselage. This sets a perfect and secure wing incidence angle and eliminates unsightly gaps at the wing-to-fuselage junction. Two screws on the inside of the fuselage secure the wing panels in place. The control surfaces are built to resemble the full-scale plane. They are built up open with the rib details showing through the covering material on the surfaces. This adds to the more accurate look overall.

Although the instructions call for a 30cc engine (and it performs well with this size engine), I installed an EME 60cc gas engine, and there is plenty of room in the cowl for the larger engine. Where I could easily reach, I did reinforce the firewall and all the joints to help support the larger engine. The weight increase of this was negligible and it is extra security for the lifespan of the plane! There is also a dummy radial engine included, and it's easy to spruce it up with added detail. (Even though that large spinner hides most of that added detail, I know it's there!)

I installed a 9-channel Spektrum receiver and used high-voltage 6150 high torque Spektrum servos for control. The stock servo cutouts easily accepted these servos with no



I took the model up high to check its slow-speed and stall characteristics. It is a well-behaved airplane at all airspeeds.

need to trim the wood. I also used a 4000mAh Spektrum LiFe battery to supply the needed voltage for the servos. With nine servos onboard I used a separate servo for each control, as well as a servo-operated choke for the engine.

IN THE AIR

Uneventful flights are the best kind of all, and that's what my first flight was. I decided to fly the plane off a full-scale runway at a local RC airplane-friendly airport. The 22x10 Falcon WW II-style prop looks great and provides excellent performance. I had no problems taxiing out to the runway and lining up the Rare Bear for takeoff.

Stability: Stability is fine and the control surfaces provide exceptional control response. I was a bit surprised at how responsive the ailerons were.

Tracking: With little rudder input, it was easy to keep the airplane down the centerline. Once airborne, I hit the retract switch and the airplane cleaned up beautifully. No changes in pitch trim were required. In all, I added three clicks of down elevator and two clicks of right aileron trim and the plane was tracking straight and true. The airplane does not sink during standard rate turns.

Aerobatics: Rolls, wing over turnarounds, inverted flight, and tight turns were all performed with no adverse reaction from the plane. Only at about 60 degrees of bank did the plane begin to pitch ever so slightly. I eased a bit off of the elevator, and the plane was back on track. I found that 90-degree banks held fairly well with rudder. The plane does not hold altitude well in a true knife edge. Inverted flight requires about one-third down elevator to hold the nose on the horizon.

Glide and Stall: When I gained some altitude to see how the Rare Bear performed at slow speeds, the first round was clean. I kept the gear retracted to see what it would do. Holding the nose up, I decreased power, and once the stall broke, the nose just came down and the plane recovered easily. Next, with the gear and flaps lowered I cut the power



The large fuselage hatch makes getting to the radio and other gear easy as can be.



A6150 Spectrum HV servos were used throughout the model. They provide excellent control response.



Coming in for a landing with flaps and landing gear extended. The Rare Bear has good slow-speed performance.

■ FIELD & BENCH REPORT: VQ WARBIRDS RARE BEAR

and held altitude. This time, the left wing dropped just a tad, but overall it was the same type of recovery. Adding some power, the plane recovers immediately and starts to climb. During landings, I was surprised by how little the engine torque affects the plane. I was able to keep the plane in the pattern with little aileron and rudder correction. Don't be afraid to slow the plane down. With the flaps and landing gear lowered, it will fly at slow airspeeds quite nicely.

PILOT DEBRIEFING

It's always a joy to have a positive experience with any new model. The VQ Warbirds Rare Bear is unique, while still based on a proven easy-to-fly design. Other than the canopy, all the formed parts are of molded fiberglass. The retracts fit snugly in place and the control surfaces are well thought out. And it flies great! Anyone who can pilot a basic sport plane should have no problem flying the Rare Bear.



Ready for its first flight, the Rare Bear goes together quickly and the Spektrum DX18 is a perfect match.



The canopy comes with a pilot figure and detailed instrument panel.

GEAR USED

-  **RADIO**
Spektrum DX 18, HV 6150 High Torque Servos, and 9-channel receiver (horizonhobby.com)
-  **ENGINE**
EME 60cc (vqwarbirds.com)
-  **PROPELLER**
Falcon 22x10 WW II Prop (justmodelprops.com)

IN THE FAST LANE



The full-size Rare Bear racer has worn several colorful paint schemes. This is the most recent.

Rare Bear is a highly modified post-WW II Grumman F8F Bearcat that has dominated the Reno Air Races for decades. The airframe that ultimately became the Rare Bear was a severely damaged wreck when Lyle Shelton discovered it in 1969. It had been abandoned right next to a runway in Valparaiso, Indiana after it crashed there in 1962. The airframe had been stripped of parts, so Shelton found a fuselage, wing center section, landing gear, and a right wing panel, but little else. He purchased the wreck and had the pieces trucked home so the restoration could begin.

One of the major modifications made during the rebuild was installing a more powerful Wright R-3350 (from a Douglas Skyraider) in place of the Pratt & Whitney R-2800 engine, which is standard for a Bearcat. A Douglas DC-7 propeller and cowl were also used. With a new windshield and canopy design, the rebuild was finished and the first flight took place on September 13, 1969.

A week after its first flight, the Bearcat appeared in its first National Championship Reno Air Race, sporting the name *Able Cat*, where it finished a respectable fifth place in the Unlimited Class. From 1969 to 1975, Lyle Shelton raced the aircraft (named *Phoenix I*) every year at the Reno Air Races until 1976, when an engine problem caused it to perform a belly landing. It did not race again until 1980. In late 2006, both the plane and the race team were sold to Rod Lewis for just under \$2 million. Since then, the Rare Bear has won several classes while wearing different paint schemes and has performed extremely well throughout the rest of its racing career.

BOTTOM LINE

Overall, I am very impressed with the quality of the model and the fit of all the parts. It is obvious that the model was designed with a lot of attention given to detail. If you are looking for an exciting Reno racer that's just as impressive as any warbird, the Rare Bear from VQ Warbirds has you covered! ➦

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GALLERY

BY THE MODEL AIRPLANE NEWS CREW | PHOTOS BY RICH URAVITCH & DAVID HART



From any angle, the mighty WACO looks amazing. It's hard to tell it from the full-size classic.

MONSTER WACO YMF-5

Dave Collis's 40%-scale classic biplane

With the many impressive RC shows that take place at the world-famous Paradise Field in Lakeland, Florida, there are scores of RC pilots and all types of great-looking and performing scale airplanes enjoying the often perfect weather and flying conditions. These events draw giant-scale enthusiasts from all over the States and even the Great White North of Canada. Dave Collis of Pitt Meadows, British Columbia has made the long trip to Florida more than once, and he has had a fair amount of success with his amazing WACO biplane.

Model Airplane News contributor Rich Uravitch caught up with Dave to talk about his beautiful cream and green biplane. Here is Dave's backstory.

AT A GLANCE

MODEL

WACO YMF-5

TYPE

Scale biplane

SCALE

40%

KIT

AMR (amr-rc.com)

WINGSPAN

142 in. (top wing)

WEIGHT

76 lb.

POWER

Moki 400cc radial engine



Dave Collis (right) and his caller keep an eye on his award-winning 40%- scale YMF-5 WACO.

MAN: Your WACO is among the most impressive planes here. Can you tell us a little about your project?

DC: My WACO is a YMF-5 version and it is built from the AMR kit [info@amr-rc.com]. It is 40 percent scale and it weighs in at 76 pounds. It has a wingspan of 142 inches (top) and 127 inches (bottom), and it uses a true scale airfoil. The fuselage length is 108 inches and it has a total wing area of

6,052 square inches. The wing loading is very friendly at under 23 ounces per square foot. It features plug-in wing and stabilizer panels. The plane is a great build. The kit comes with great-fitting parts and several alignment jigs, so everything is very easy to put together. It is just about foolproof. As for the building time, I started the project in February and it was flying at the end of July.

MAN: How about the finish and details?

DC: Well, I like scale airplanes, but I'm not a scale competitor, per se. I went online to find an attractive paint scheme and I found a WACO (not a YMF-5) with this simple yet attractive green and cream scheme with black strips so I went ahead and applied it to my WACO. I used the Stits Lite covering system from F&M Enterprises and I used their Poly-Tone



Dave readies his WACO for another flight at Paradise Field with the help of some of the host club's linemen.



You get a good sense of just how big Dave's WACO is when you see it on the flightline.

paint system as well. All the scale details are homemade using photos I found online, and I made the access panels all functional so I could get inside the model without too much trouble. All the panel screws are from micro fasteners and are all functional.

I love the scale flying wires, which are custom-made by Aeroscale Products in Switzerland and are just amazing. All I had to do was send them all my dimensions, and a couple weeks later I got them in the mail. They have

functional reverse-thread clevises so they are fully adjustable. I made the aileron corrugations from litho-plate aluminum and formed them with a simple plywood form I made in the shop. They were quick and easy to make, taking about 10 to 30 minutes to produce each one.

MAN: What do you use for a radio system and engine?

DC: I use a JR 9303 transmitter, and

each half of the airplane has its own receiver. The radio gear is all JR, and each receiver has two battery packs and two switches for redundancy. I use two Spektrum AR921 receivers. There's also a separate battery pack for the ignition system and another for the electric fuel pump. For the flying surfaces servos, I have one Hitec 7955 per aileron, one Hitec 7955 per elevator half, two Hitec 7980s for rudder, and one Hitec 7990 for the tailwheel steering. I also use a Hitec 645 for the



With a very pilot-friendly wing loading, the WACO is relatively easy to control, and it looks majestic coming in for a smooth touchdown.



Powered by a big and impressive Moki 400cc radial engine, the mighty YMF-5 WACO sounds as good as it looks flying by.

throttle and the engine choke. As for the engine, the WACO is powered by a Moki 400cc radial engine. It fits nicely within the 16-inch cowl and has no trouble turning the big 40x18 Biela carbon fiber propeller.

MAN: Tell us how the plane flies and how it has performed for you.

DC: Well, with some 6,000-plus wing area and a relatively light wing loading, the WACO is a beautiful flying airplane. There's nothing difficult about it. It has plenty of power and it's like flying

around a great big Eagle II trainer. It now has 62 flights on it, the last 10 of which I flew at Monster Planes 2013. I have been lucky enough to receive both the Best Civilian Aircraft and the runner-up Critic's Choice awards in 2011, and this year we brought home the Best Pre-WW II award.

It's a 7,000-mile roundtrip from Vancouver to Lakeland, and it takes me seven days each way. I tow my travel trailer and camp each night, so I think it is well worth the drive to fly here at Paradise Field. Frank Tiano and all his

staff do an amazing job running this great giant-scale event and I just love flying my WACO here.

MAN: Do you have any comments for people wanting to build and fly the AMR WACO?

DC: To anyone thinking about building this plane, I'd recommend moving the balance point to 28 percent of total chord (that is the only change I made to the kit). Also, this is a big plane, so you'll need lots of room to build, store, and transport it! ✈

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COMPARE TO \$14.99

MODEL: 25521

ITEM 62434, 62426, 62433, 62432, 62429, 64179, 62428, 64178 shown



22088731

LIMIT 5 - Coupon valid through 5/3/20*

PORTLAND

Customer Rating ★★★★★

1750 PSI ELECTRIC PRESSURE WASHER

NOW \$179.99

\$99.99

COMPARE TO \$174.44

MODEL: 20600

ITEM 63255/63254 shown



22099194

LIMIT 2 - Coupon valid through 5/3/20*

WARRIOR

Customer Rating ★★★★★

4-1/2" CUT-OFF WHEELS FOR METAL PACK OF 10

NOW \$5.99

\$8.35

COMPARE TO \$19.97

MODEL: DBD045063710F

ITEM 61195 45430 shown



22117653

LIMIT 5 - Coupon valid through 5/3/20*

WARRIOR

Customer Rating ★★★★★

18V LITHIUM-ION 3/8" DRILL/DRIVER KIT

NOW \$27.99

\$37.99

COMPARE TO \$74

MODEL: P1810

ITEM 64118



22126732

LIMIT 5 - Coupon valid through 5/3/20*

SUPER COUPON

OVER 5,000 5 STAR REVIEWS

FREE

SUPER BRIGHT LED/SMD WORK LIGHT/FLASHLIGHT

- Super-Strong, Ultra-Lightweight Composite Plastic
- Magnetic Base & 360° Swivel Hook for Hands-Free Operation
- 3-AAA Batteries (included)
- 144 Lumens

ALL IN A SINGLE SUPER POWERFUL LIGHT

ITEM 63878/63991 64005/60566 63601/67227 shown

COMPARE TO PERFORMANCE TOOL MODEL: W2364

22073843

Cannot be used with other discounts or prior purchases. Original coupon must be presented. Valid through 5/3/20 while supplies last. Limit 1 FREE GIFT per customer per day.

SUPER COUPON

20% OFF

ANY SINGLE ITEM*

22075854

Limit 1 coupon per customer per day. Save 20% on any 1 item purchased. *Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, Extended Service Plan, gift card, open box item, 3 day Parking Lot Sale item, compressors, floor jacks, sales, storage cabinets, chests or cars, trailers, welders, Admiral, Ames, Atlas, Bauer, Central Machinery, Cobra, CoverPro, Dayton, Diamondback, Earthquake, Fischer, Hercules, Icon, Juniper, Lynx, Poulan, Predator, Tailgator, Viking, Vulcan, Zurich. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 5/3/20.

PREDATOR

Customer Rating ★★★★★

3500 WATT SUPER QUIET INVERTER GENERATOR

NOW \$699.99

\$799.99

COMPARE TO \$2,019

HONDA MODEL: EU3000iSA

ITEM 56720/63584 shown



22093828

LIMIT 1 - Coupon valid through 5/3/20*

BRAUN

Customer Rating ★★★★★

5000 LUMEN, 4 FT. LED HANGING SHOP LIGHT

- 30,000 hour LED life
- Sturdy lightweight design (1.75 lbs.)

NOW \$19.99

SAVE 33%

ITEM 64410

22089392

LIMIT 3 - Coupon valid through 5/3/20*

HaulMaster

Customer Rating ★★★★★

18" WORKING PLATFORM STEP STOOL

NOW \$19.99

\$29.99

COMPARE TO \$39.99

MODEL: 60635

ITEM 62515/66911 shown



22099243

LIMIT 4 - Coupon valid through 5/3/20*

PITTSBURGH

Customer Rating ★★★★★

10" PNEUMATIC TIRE

NOW \$3.99

SAVE 50%

COMPARE TO \$8.09

FARM & RANCH MODEL: FR1055

ITEM 69385/62388/62409/62698/30900 shown



22107318

LIMIT 4 - Coupon valid through 5/3/20*

CENTRAL MACHINERY

Customer Rating ★★★★★

4" x 36" BELT/6" DISC SANDER

NOW \$64.99

\$77.99

COMPARE TO RYOBI \$149

MODEL: BD4601G

ITEM 5154 64778/97181 shown



22119656

LIMIT 2 - Coupon valid through 5/3/20*

PITTSBURGH

Customer Rating ★★★★★

CLICK-TYPE TORQUE WRENCHES

LIFETIME WARRANTY

• Reversible

DRIVE ITEM

1/4" 61277/63881/2696

3/8" 61276/63880/807

1/2" 62431/63882/239

Item 239 shown

COMPARE TO HUSKY \$89.97

MODEL: H20TWA

SAVE 88%

YOUR CHOICE \$9.99

22120987

LIMIT 4 - Coupon valid through 5/3/20*

PITTSBURGH

Customer Rating ★★★★★

4" RATCHETING BAR CLAMP/SPREADER

NOW 99¢

\$1.99

COMPARE TO IRWIN \$6.49

MODEL: 1964747

ITEM 46805 62242/68974 shown



22135324

LIMIT 5 - Coupon valid through 5/3/20*

COVERPRO

Customer Rating ★★★★★

10 FT. x 20 FT. PORTABLE CAR CANOPY

NOW \$99.99

SAVE \$99

COMPARE TO SHELTER LOGIC \$199

MODEL: 23522

ITEM 63054/62858 shown



22140402

LIMIT 2 - Coupon valid through 5/3/20*

VIKING **SUPER COUPON**

JUMP STARTER AND POWER PACK

Customer Rating ★★★★★

NOW \$69⁹⁹

~~\$79⁹⁹~~

SAVE \$70

COMPARE TO SCHUMACHER **\$139⁹⁹**

ELECTRIC MODEL: SL1

ITEM 56797/56798 64412/62749 shown

22144922

LIMIT 2 - Coupon valid through 5/3/20*

HaulMaster **SUPER COUPON**

72" x 80" MOVING BLANKET

Customer Rating ★★★★★

NOW \$5⁹⁹

~~\$8⁹⁹~~

SAVE 70%

COMPARE TO BLUE HAWK **\$19⁹⁹**

MODEL: 77280

ITEM 69505/62418/66537 shown

22175446

LIMIT 5 - Coupon valid through 5/3/20*

McGRAW **SUPER COUPON**

20 GALLON, 135 PSI OIL-LUBE AIR COMPRESSOR

Customer Rating ★★★★★

NOW \$174⁹⁹

~~\$199⁹⁹~~

SAVE \$75

COMPARE TO PORTER-CABLE **\$249⁹⁹**

MODEL: 118903799

ITEM 56241/64857 shown

22175901

LIMIT 1 - Coupon valid through 5/3/20*

Handle and Protective Shroud

Powerful Induction Motor "Won't trip your breaker"

Easy Access Drain Valve

135 Max. PSI
1.6 Running HP
4.0 SCFM
Oil Lube Pump

2x LIFE
25% QUIETER
27% MORE RUN TIME

Large Rubber Wheels

Rubber Foot Stabilizers

WARRIOR **SUPER COUPON**

29 PIECE TITANIUM DRILL BIT SET

Customer Rating ★★★★★

NOW \$10⁹⁹

~~\$18⁹⁹~~

SAVE 83%

COMPARE TO DEWALT **\$68¹⁴**

MODEL: DW1369

ITEM 5889/62281/61637 shown

22185858

LIMIT 4 - Coupon valid through 5/3/20*

AVANTI **SUPER COUPON**

HVLP HANDHELD PAINT SPRAYER

Customer Rating ★★★★★

NOW \$69⁹⁹

~~\$99⁹⁹~~

SAVE \$29

COMPARE TO WAGNER **\$99**

MODEL: Control Stainer 350

ITEM 64934

22191181

LIMIT 1 - Coupon valid through 5/3/20*

HaulMaster **SUPER COUPON**

30" x 18" HARDWOOD DOLLY

• 1000 lb. capacity

Customer Rating ★★★★★

NOW \$11⁹⁹

~~\$15⁹⁹~~

SAVE 39%

COMPARE TO MILWAUKEE **\$19⁹⁷**

MODEL: 33700

ITEM 38970/92486/39757/60496/62398/61897 shown

22193970

LIMIT 4 - Coupon valid through 5/3/20*

THUNDERBOLT solar **SUPER COUPON**

100 WATT SOLAR PANEL KIT

Customer Rating ★★★★★

NOW \$149⁹⁹

~~\$189⁹⁹~~

SAVE \$142

COMPARE TO WINDYATION **\$292⁴⁴**

MODEL: SOK-100WP-P30L

ITEM 64335/63585 shown

22195914

LIMIT 1 - Coupon valid through 5/3/20*

RENEWABLE ENERGY ANYWHERE

2X MORE POWER

PITTSBURGH AUTOMOTIVE **SUPER COUPON**

1 TON CAPACITY FOLDABLE SHOP CRANE

• Boom extends from 34" to 45"
• Crane height adjusts from 69-5/8" to 82"

Customer Rating ★★★★★

NOW \$139⁹⁹

~~\$189⁹⁹~~

SAVE \$90

COMPARE TO GOPLUS **\$229⁹⁹**

MODEL: GP-101040150

ITEM 69512 61858 shown

22196157

LIMIT 1 - Coupon valid through 5/3/20*

luminar OUTDOOR **SUPER COUPON**

24 FT., 18 BULB, 12 SOCKET OUTDOOR LINKABLE STRING LIGHTS

Customer Rating ★★★★★

NOW \$21⁹⁹

~~\$27⁹⁹~~

SAVE 44%

LINK UP TO 9 STRINGS

BLACK WHITE

ITEM 64486 ITEM 64739

63483 shown

COMPARE TO PORTFOLIO **\$39⁹⁸**

MODEL: SLC12BK

ITEM 64934

22198181

LIMIT 3 - Coupon valid through 5/3/20*

YOUR CHOICE OF COLOR

PORTLAND **SUPER COUPON**

7 AMP ELECTRIC POLE SAW

9.5" BAR

Customer Rating ★★★★★

NOW \$59⁹⁹

~~\$79⁹⁹~~

SAVE \$39

COMPARE TO WORX **\$99⁹⁸**

MODEL: WG309

ITEM 68862/63190/56808/62896 shown

22202604

LIMIT 1 - Coupon valid through 5/3/20*

6 ft. to 8 ft. 10"

WARRIOR **SUPER COUPON**

3 PIECE HEX SHANK SOCKET DRIVER SET

Customer Rating ★★★★★

NOW \$29⁹⁹

~~\$49⁹⁹~~

SAVE 81%

COMPARE TO DEWALT **\$159⁸**

MODEL: DWA2240IR

ITEM 63909/63928/68513 shown

22203961

LIMIT 5 - Coupon valid through 5/3/20*

1/4"

3/8"

1/2"

CHICAGO ELECTRIC POWER TOOLS **SUPER COUPON**

6 AMP VARIABLE SPEED RECIPROCATING SAW

Blade sold separately.

Customer Rating ★★★★★

NOW \$19⁹⁹

~~\$28⁹⁹~~

SAVE 66%

COMPARE TO PORTER-CABLE **\$59⁹⁸**

MODEL: PCE360

ITEM 65570/61884/62370 shown

22204225

LIMIT 3 - Coupon valid through 5/3/20*

PITTSBURGH AUTOMOTIVE **SUPER COUPON**

300 LB. CAPACITY ATV/LAWN MOWER LIFT

Customer Rating ★★★★★

NOW \$74⁹⁹

~~\$99⁹⁹~~

SAVE \$46

COMPARE TO MAX LOAD **\$121⁴⁷**

MODEL: 38028

ITEM 60395/62325/62493/61523 shown

22209941

LIMIT 1 - Coupon valid through 5/3/20*

Quantum **SUPER COUPON**

588 LUMEN TACTICAL FLASHLIGHT

Customer Rating ★★★★★

NOW \$9⁹⁹

~~\$14⁹⁹~~

SAVE 83%

COMPARE TO STREAMLIGHT **\$59⁹⁹**

MODEL: PROTAC 1L

ITEM 64799/63934 shown

22210273

LIMIT 4 - Coupon valid through 5/3/20*

5"

WINDSOR DESIGN **SUPER COUPON**

60" HARDWOOD WORKBENCH WITH 4 DRAWERS

Customer Rating ★★★★★

NOW \$119⁹⁹

~~\$149⁹⁹~~

SAVE \$279

COMPARE TO GRIZZLY **\$399⁹⁵**

MODEL: H7723

ITEM 63395/93454/69054/62603 shown

22217381

LIMIT 1 - Coupon valid through 5/3/20*

Tools sold separately.

PITTSBURGH **SUPER COUPON**

130 PIECE TOOL KIT WITH CASE

SAE AND METRIC

Customer Rating ★★★★★

NOW \$29⁹⁹

~~\$39⁹⁹~~

SAVE 54%

COMPARE TO ANVIL **\$66³⁹**

MODEL: A137HOS

ITEM 68998/63248/64080/64263/63091 shown

22217953

LIMIT 2 - Coupon valid through 5/3/20*

LIFETIME WARRANTY

PITTSBURGH AUTOMOTIVE **SUPER COUPON**

MULTI-USE TRANSFER PUMP

Customer Rating ★★★★★

NOW \$3⁹⁹

~~\$6⁹⁹~~

SAVE 73%

COMPARE TO SHOP CRAFT **\$14⁹⁹**

MODEL: 36667

ITEM 63144/3878/61364/63591/66418 shown

22223486

LIMIT 4 - Coupon valid through 5/3/20*

CHICAGO ELECTRIC POWER TOOLS **SUPER COUPON**

10" SLIDING COMPOUND MITER SAW

• Powerful 15 amp motor

Customer Rating ★★★★★

NOW \$94⁹⁹

~~\$119⁹⁹~~

SAVE \$134

COMPARE TO KOBALT **\$229**

MODEL: SM2516LW

ITEM 61972 56708 61971 shown

22225942

LIMIT 2 - Coupon valid through 5/3/20*

Blade sold separately.

SUPER COUPON

AMMO DRY BOX

Customer Rating ★★★★★

NOW \$3⁴⁹

~~\$5⁹⁹~~

SAVE 65%

COMPARE TO RANGEMAXX **\$9⁹⁹**

MODEL: 1312-92

ITEM 63135 61451 shown

22233911

LIMIT 5 - Coupon valid through 5/3/20*

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*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 5/3/20.

At Harbor Freight Tools, the "Compare to" price means that the specified comparison, which is an item with the same or similar function, was for sale at or above the "Compare to" price by another national retailer in the U.S. within the past 90 days. Prices advertised by others may vary by location. No other meaning of "Compare to" should be implied. For more information, go to HarborFreight.com or see store associate.

A detailed scale model of a Le Rhone rotary engine is mounted on a triplane fuselage. The engine is a light blue color with a large wooden propeller. The triplane has three sets of wings. The background is a workshop with shelves and tools.

HOW TO

TEXT & PHOTOS BY BRIAN PERKINS

Even sitting still, the scale Le Rhone rotary engine looks impressive. It will be amazing to see it spinning in the cowlings as the triplane makes a low strafing run.

BUILD THE ULTIMATE DUMMY ENGINE

It's scale and it spins!

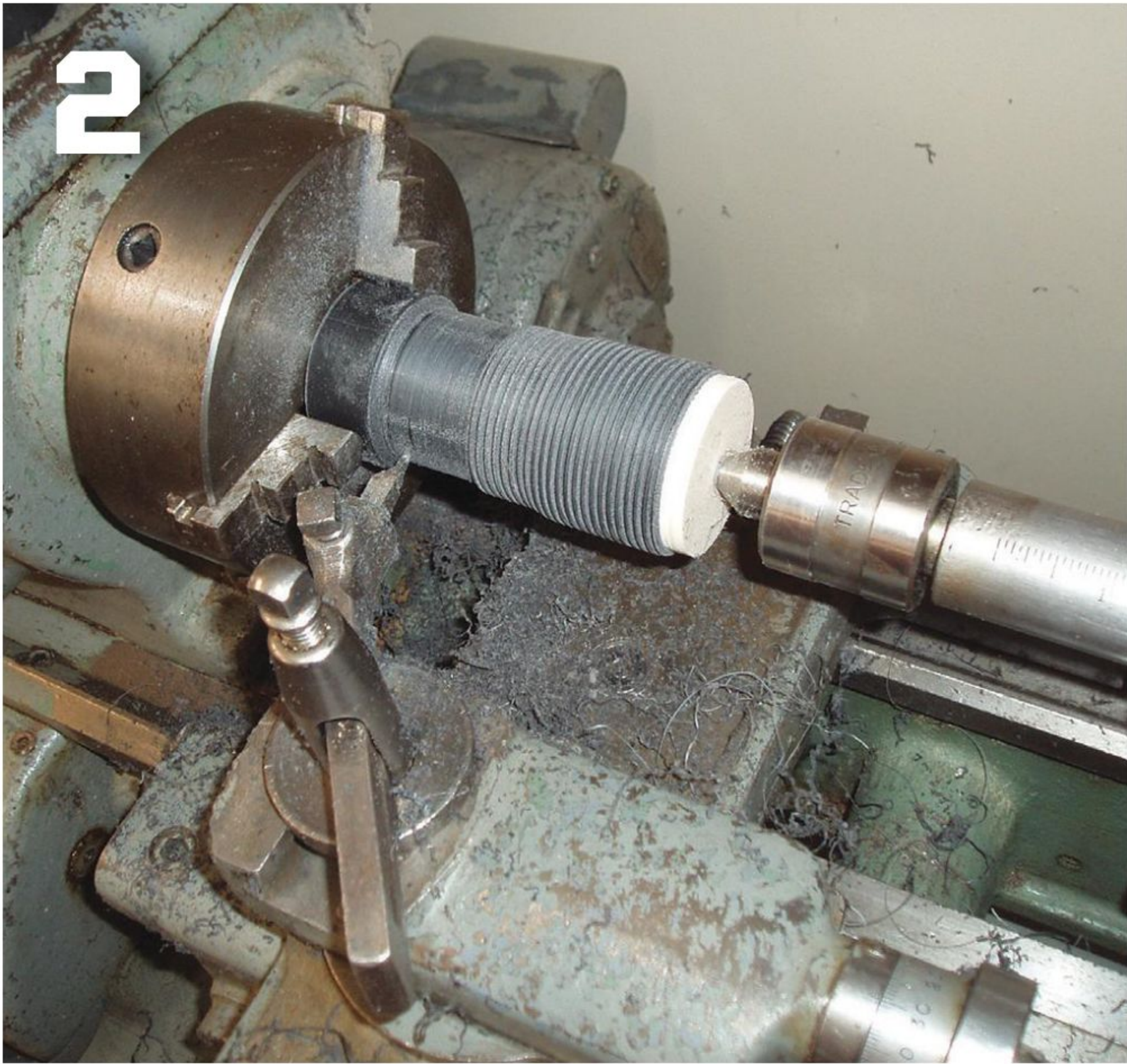
My flying buddy Martin Irvine and I were fortunate to both win Balsa USA 1/3-scale Fokker DR-I kits at the always awesome Old Rhinebeck WW I R/C Jamboree. As Martin was finishing up his current project, a 1/3-scale Thomas Morse Scout, I got a head start and began my build. I thought I would add some interesting features, one of them being a scratch-built scale dummy rotary engine that I would mount on a large bearing, so it would rotate within the cowl for scale affect. I couldn't attach it directly to the propeller, so I designed it so that it would spin with the airflow coming from the propeller.

To power my triplane, I used a DLE-111 twin-cylinder gas engine, and that required a custom prop extension so that the engine could be installed far enough back to allow room for the dummy engine. Here's how I did it!

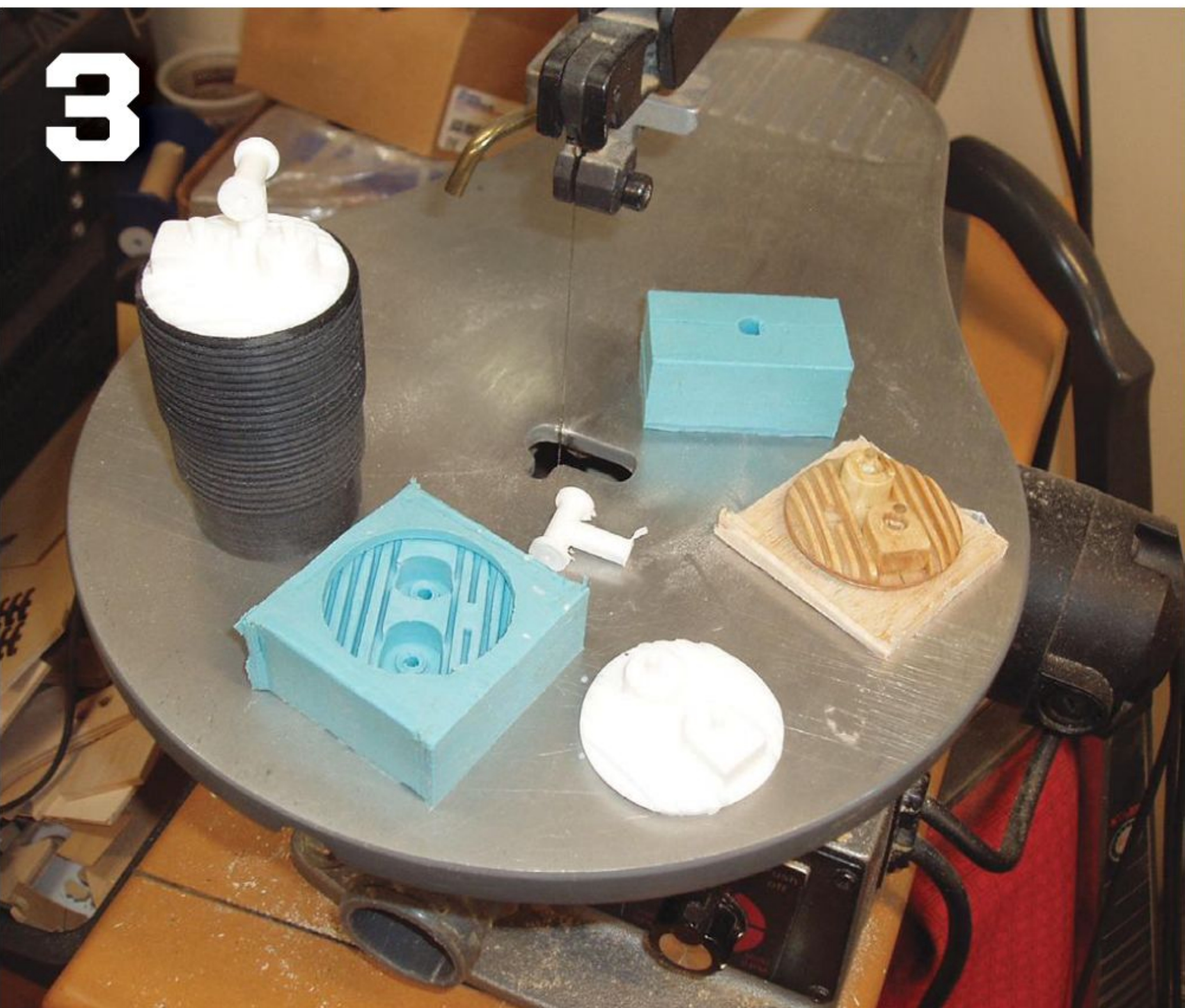
IN THE WORKSHOP



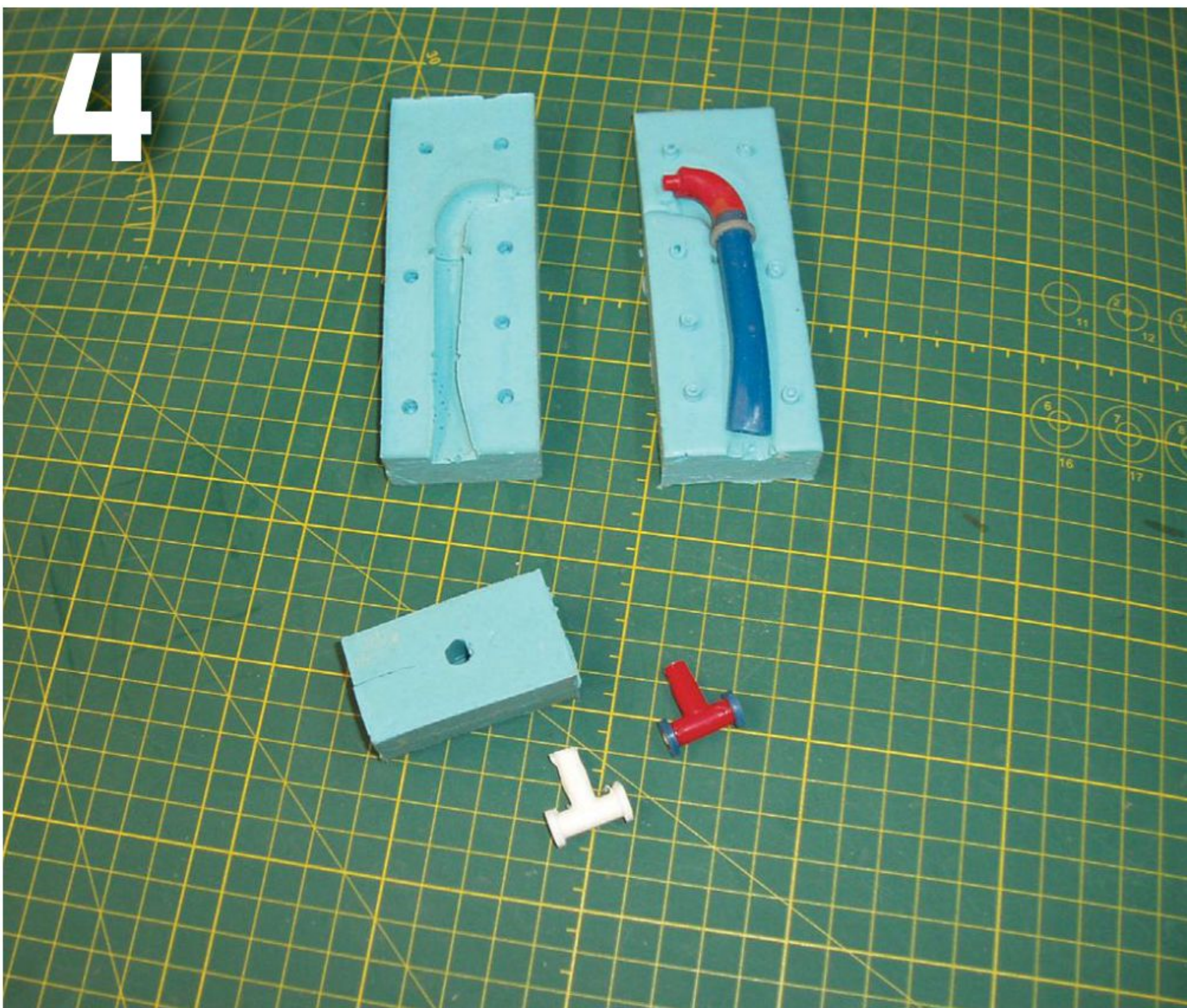
For my scale 9-cylinder Le Rhone rotary engine, I found that 1 1/2-inch ABS water pipe was the perfect size for turning the cylinders on my lathe.



The end of the pipe is supported with a wooden plug, so each cylinder could be turned in the three-jaw chuck. It took about 30 minutes per cylinder, but the detail of the cooling fins was worth it.



As it was necessary to fabricate nine identical cylinders, I chose to replicate the cylinder heads and other bits using two-part silicone molds and casting resin. The cylinder head master was made from basswood and ply, other bits from plastic.

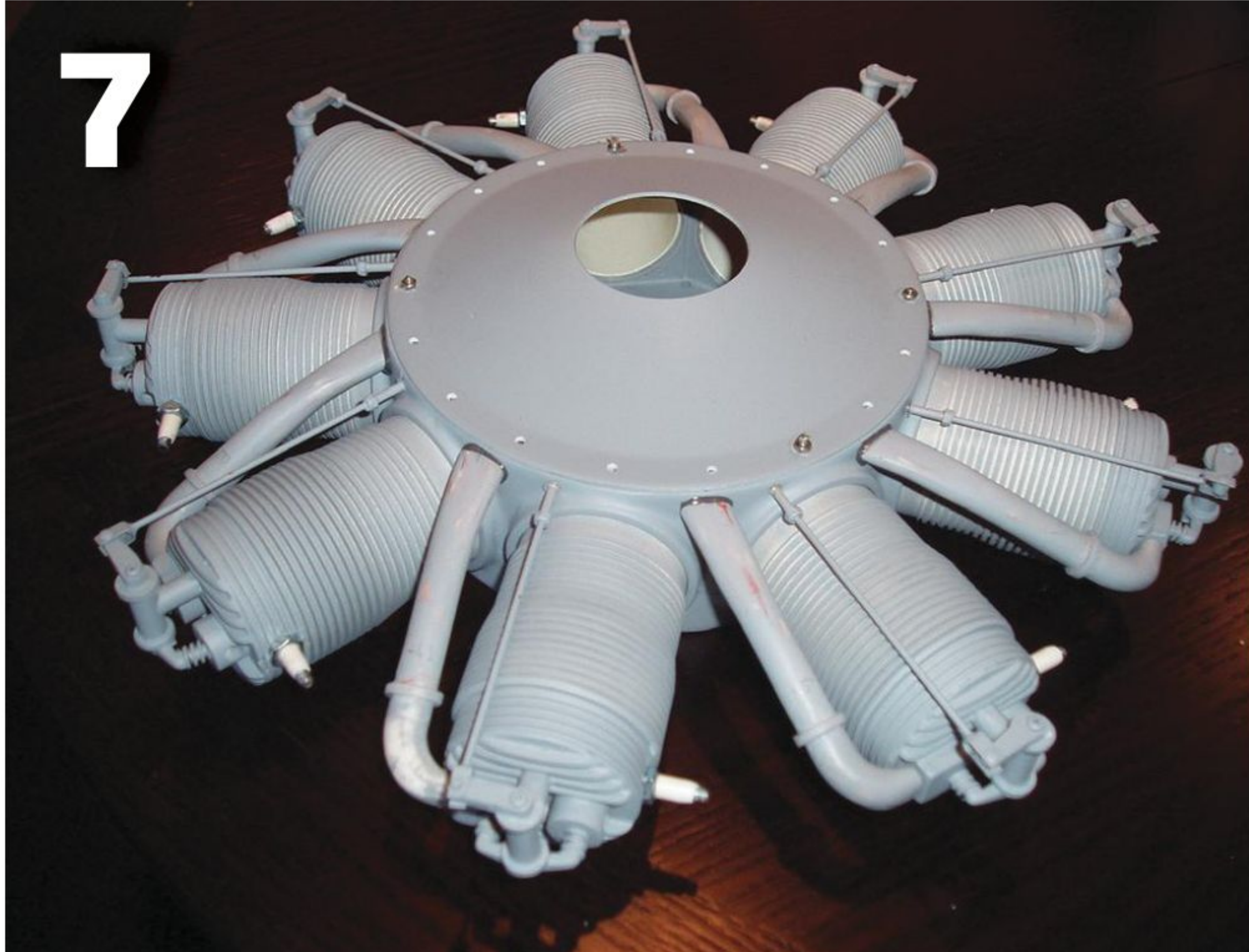


The molds for the rocker assembly and the intake manifolds. This is the only way to go when you have to make nine of each part.

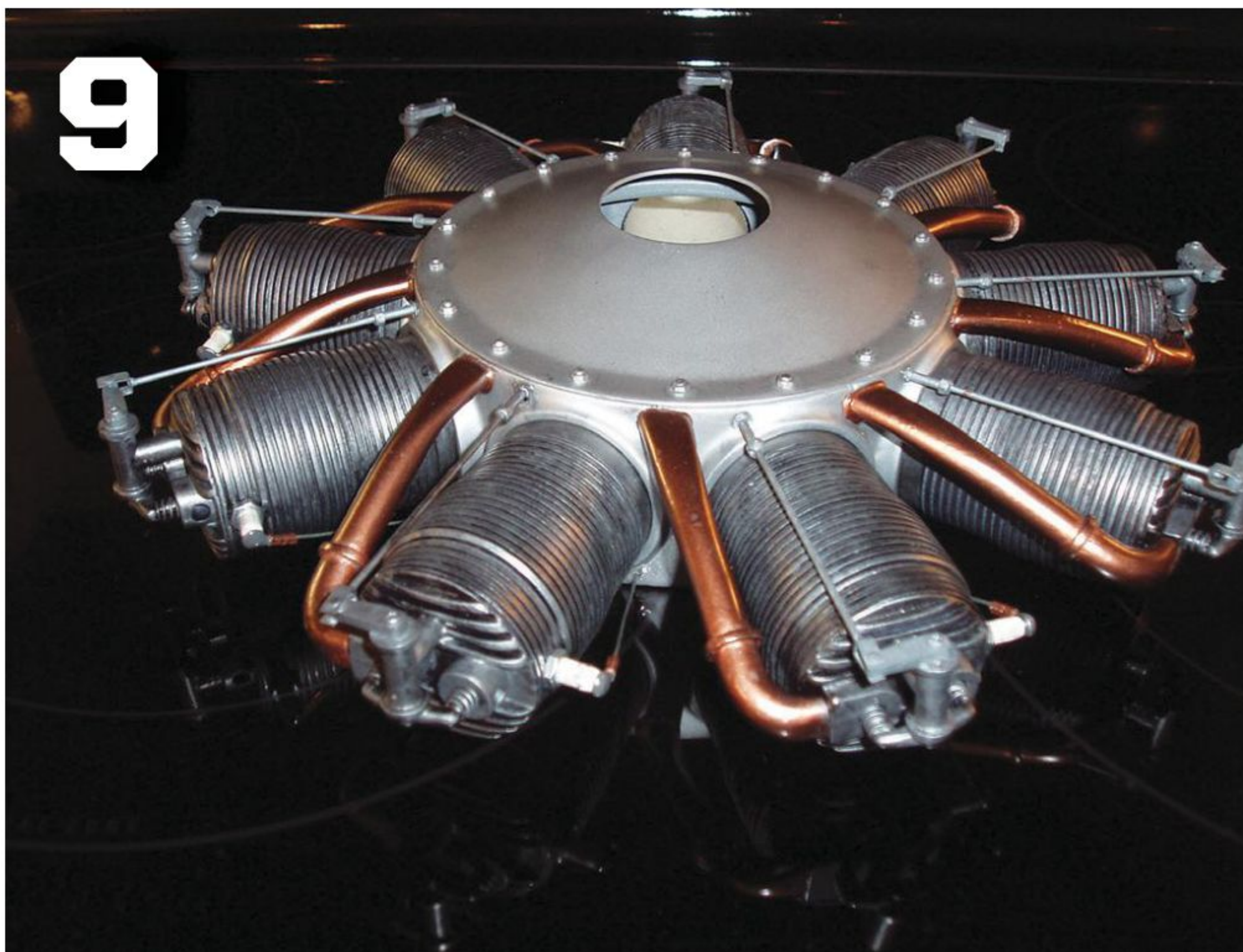
■ HOW TO: BUILD THE ULTIMATE DUMMY ENGINE



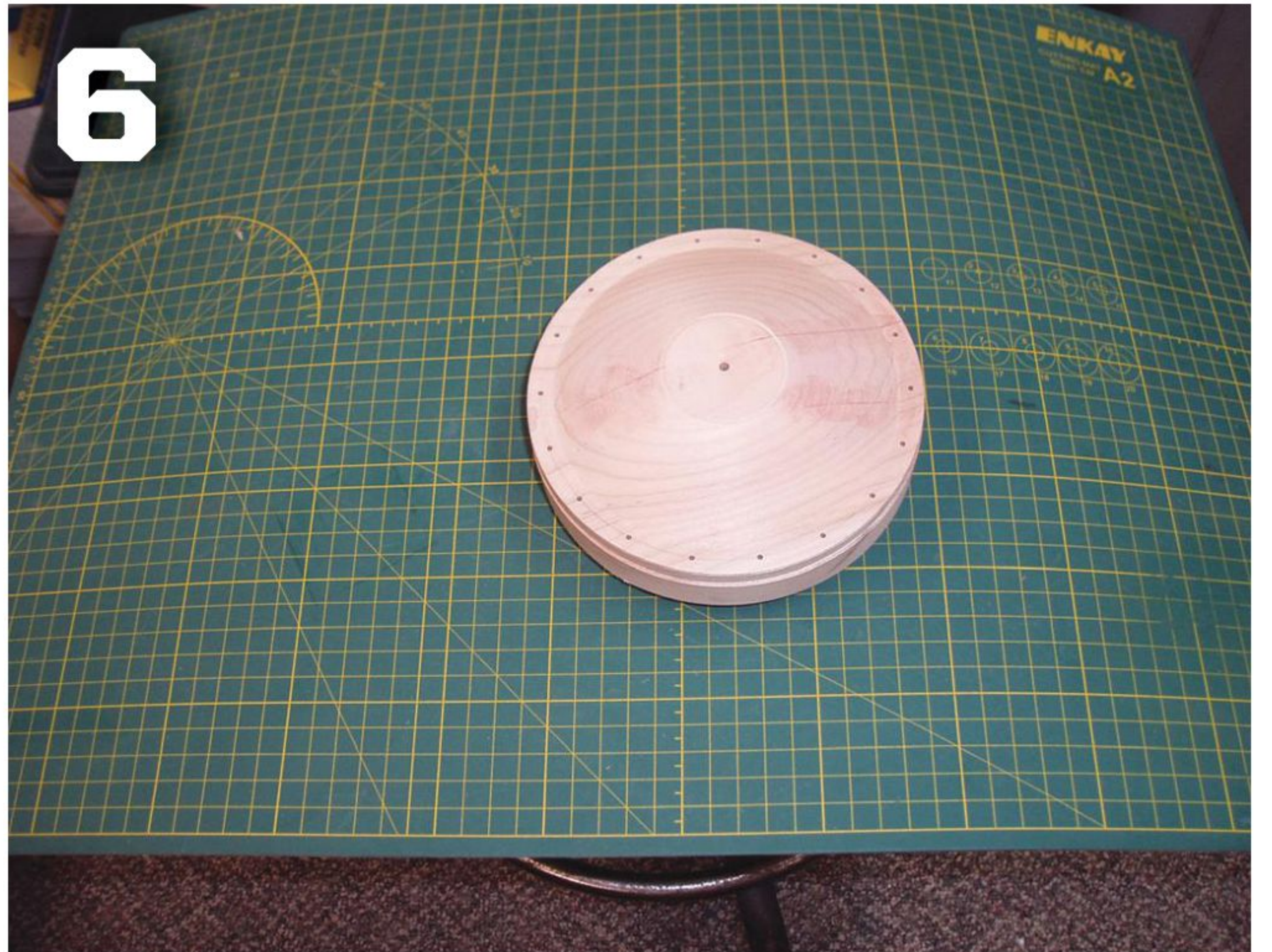
My friend Rolly Siemonsen saved me a lot of time by cutting out the crankcase parts with great precision using his laser cutter. The inside of the crankcase has nine rectangle sides with holes in them that match the base of the cylinders. The rings used to form the bearing attachment bracket are also shown here.



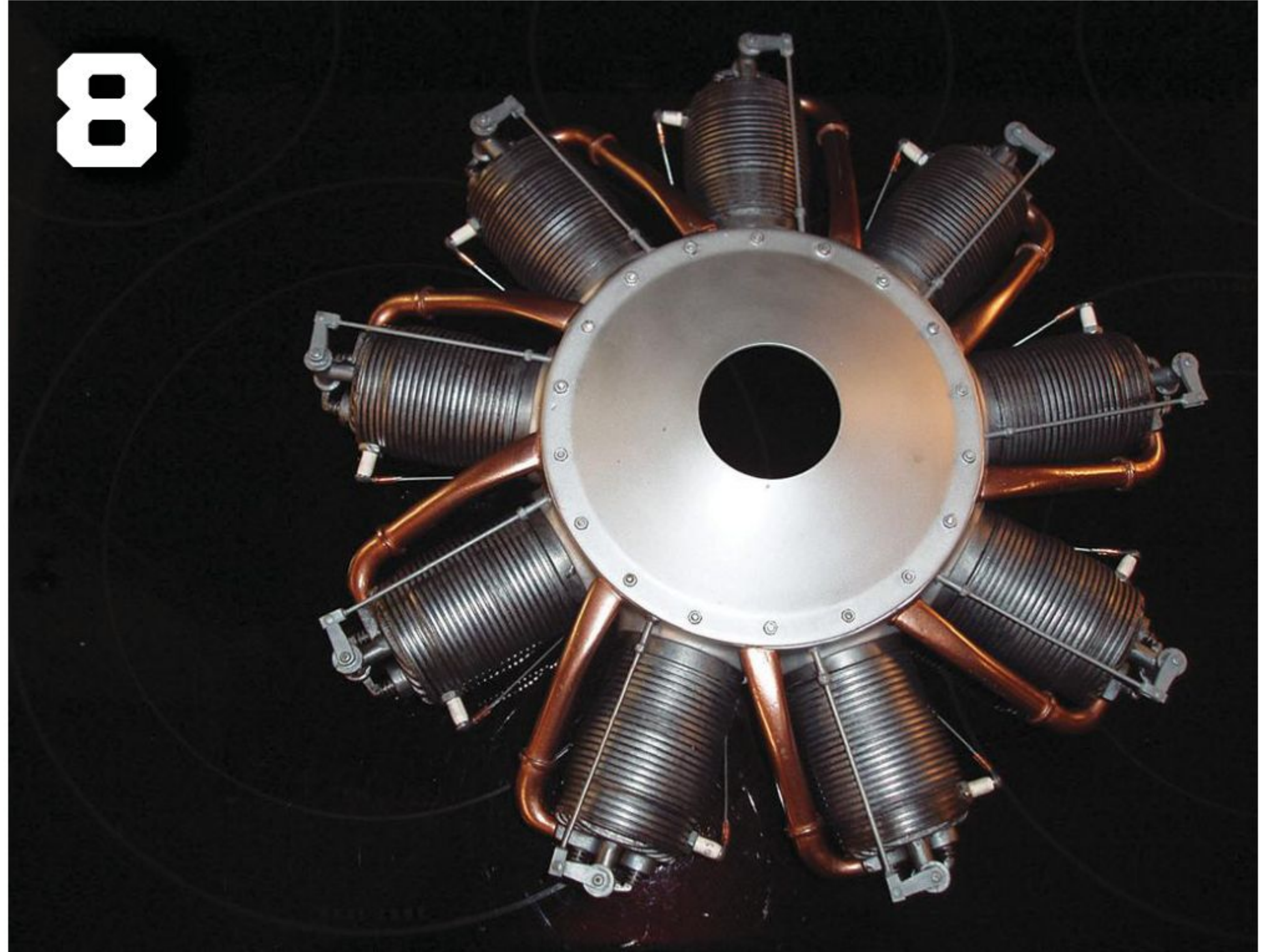
Here is the assembled rotary engine with a light coat of primer added. Other details for the valve lifters are made from small laser-cut parts and music wire for the pushrods.



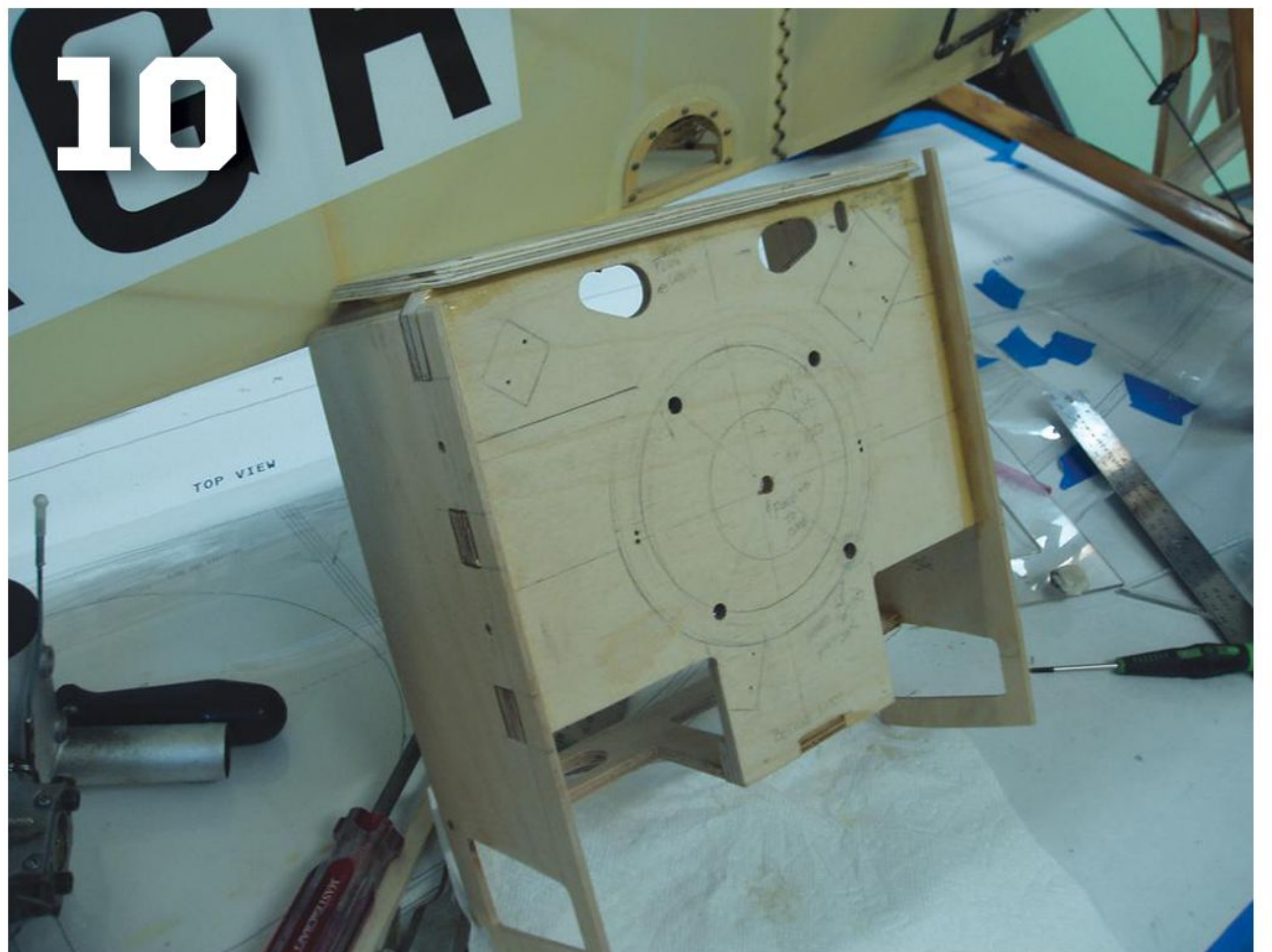
I discovered that by rubbing the copper paint with a rag loaded with powdered graphite lubricant, the final results were much more realistic.



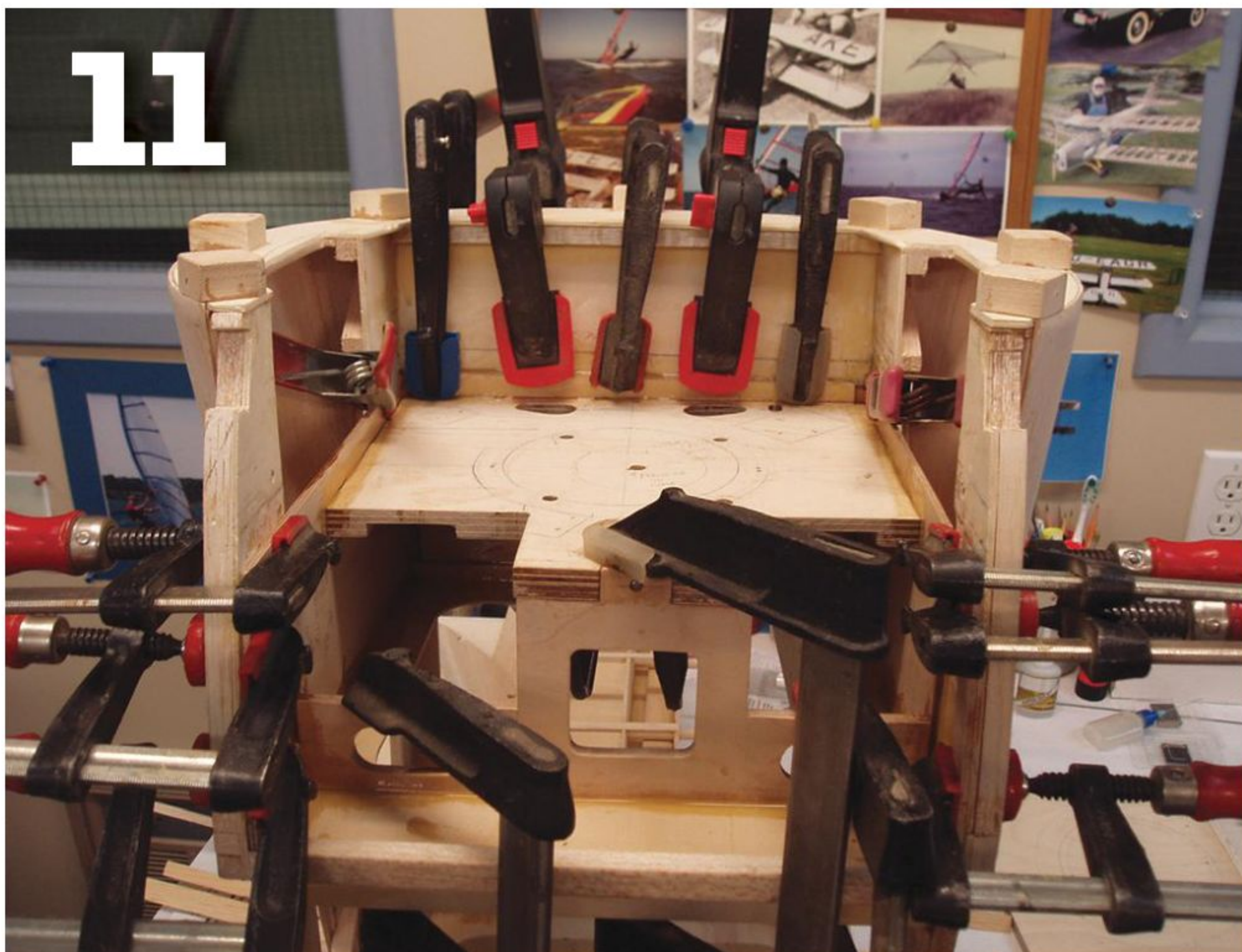
This is the wood master I turned to shape on my lathe for forming the crankcase cover. The cover was vacuum formed from 0.060-inch styrene plastic sheet.



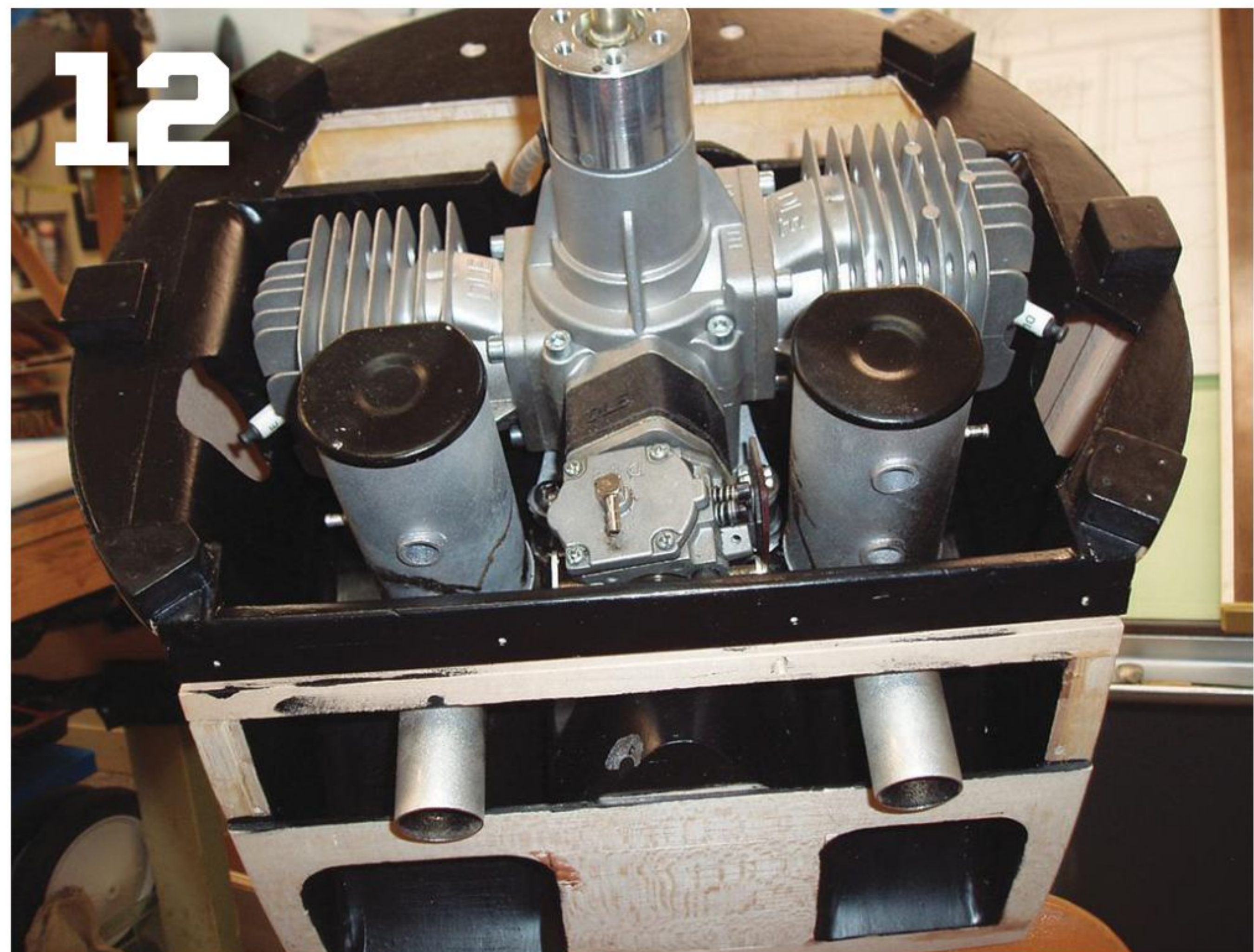
The painted engine looks great. I sprayed the crankcase with aluminum paint and painted the cylinders gunmetal grey, and then dry brushed them with aluminum. I sprayed the intake manifolds with copper paint, but I was not happy with the results because it looked like, well—copper paint!



The custom engine mount assembly I built to accommodate the DLE-111. When installed, it will locate the engine further back in the fuselage.



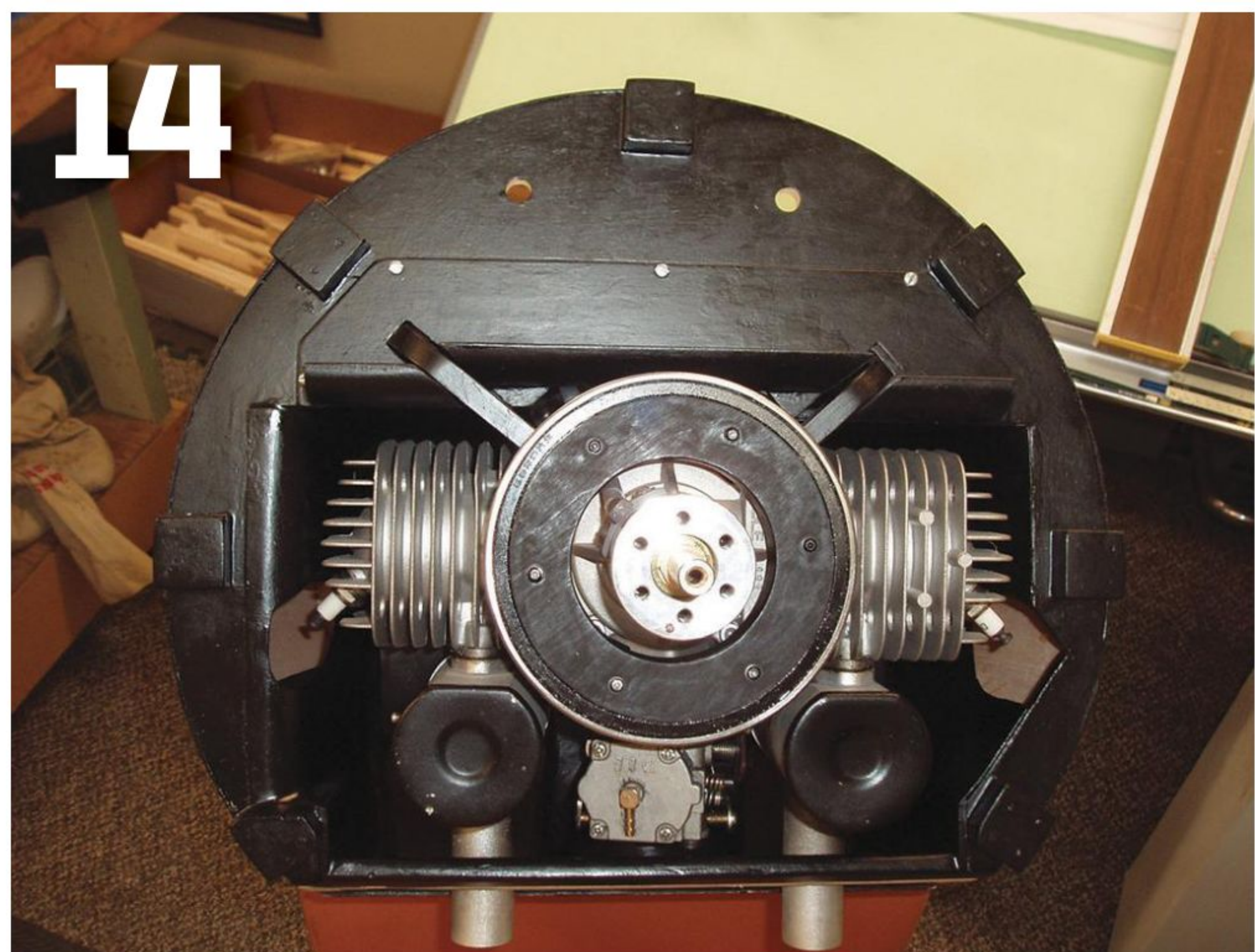
11
Here, the engine mount assembly has been epoxied and clamped into place in the fuselage.



12
My DLE-111 engine installed in the nose. Cylinder heads are baffled with 1/64-inch plywood faired in with epoxy putty to allow smooth airflow for cooling. The unpainted upper shelf will house the ignition module and ignition battery. Also shown, the cooling air outlets on the bottom and the aluminum prop shaft extension, which is 1 1/4-inch long.



13
This funny little thing is the attachment mount for the dummy engine, with the bearing installed. The awkward leg design is necessary to fit around the DLE engine. Made of plywood, the legs fasten securely to the firewall with screws.



14
The dummy engine mount assembly installed. It fits around the prop extension. Note the cover over the ignition battery compartment above the engine.



15
This side view shows the dummy engine installed. Clearance over mufflers is only 1/32 of an inch.



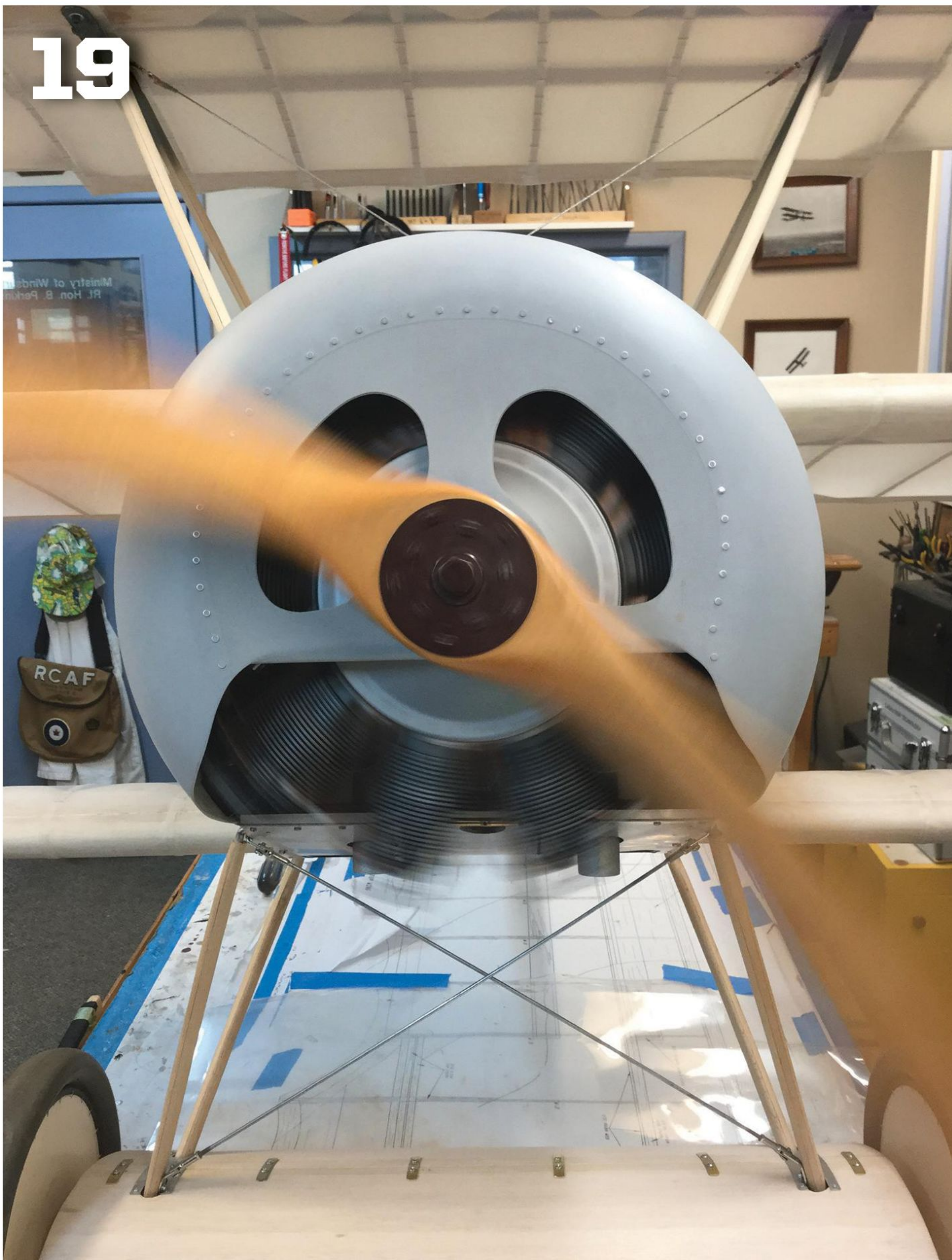
16
This view shows the cooling air and exhaust outlets on the underside. The dummy engine spins quite freely!



Dummy engine mount installed over DLE engine.



Here is the 1 1/4-inch shaft extension necessary to get the prop clear of the cowl.



The final setup with the modified engine cowl in place. The upper air inlets have been enlarged as shown on my Windsock Datafiles and documentation photographs.. Just like the full-size triplane, this arrangement will provide ample airflow to spin the dummy engine and to cool the DLE 111 behind it.

THE BOTTOM LINE

This project was really fun, and the end results will be well worth the effort. I have modified and added finer scale details to the Balsa USA kit, and it's coming along nicely. If you would like to see more about my project, you can go to: rcscalebuilder.com and find my (SE5A Jockey) "1/3-Scale BUSA Fokker DR-1 (Modified)" posts. ➦



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The membership designed for every type of RC plane enthusiast.
The HANGAR gives you exclusive discounts and an insider's view of the latest projects and products—in the workshop, at the field, and in the air.

KingTech **TURBINE K45 G3**

The ideal engine for 10- to 12-pound jets



Today, modern technology impacts our everyday lives like never before. A single smartphone has hundreds of times more computing power than that room full of computers that got us to the moon and back. In the last few years, we RC'ers have seen the widespread adoption of 2.4 frequencies that freed us from the pin and impound days, multi-axis gyros the size of a quarter, and more.

One of the areas of our hobby that has been significantly impacted by smaller, inexpensive electronic components is jet turbines. Turbine flight has long been out of the financial reach and expertise of many modelers. In addition, turbines were complicated to set up and operate, came with a steep learning curve, and often needed butane or other external means to start them.

Today, nearly every turbine is kerosene start. The electronic control unit (ECU) takes care of the entire start sequence from the time you initiate a start, and it turns over throttle control to the transmitter only when the engine reports that it has started properly and achieved stable idle rpm. If it senses any issues, the ECU will immediately shut down the engine and provide an error message to the user via radio telemetry or the ground support unit (GSU).

QUICK SPECS

Engine: Turbine K45 G3

Manufacturer: KingTech
(kingtechturbines.com)

Length: 6.2 in.

Width: 2.5 in. (engine case); 3.6 in.
(mounting rails)

Weights: 15.8 oz. (turbine); 1.3 oz.
(ECU); 1.7 oz. (pump); 2.9 oz. (wiring,
fuel shutoff, and other bits)

Max rpm: 232,000

Thrust: 4.5kg

Fuel: Jet A-1 or kerosene

Price: \$1,600.00



Photo by Anthony Lively

This brings me to the subject of this article: small turbines. Modelers with smaller electric ducted fan (EDF) jets are finding the joys of converting them to turbines. Why convert? New technology makes turbines a lot easier to install and safely operate. You also find yourself with double or better the flight time than an equivalent EDF motor. The new generation of small turbines is extremely lightweight, so a model will often weigh the same or slightly more than its EDF counterparts at takeoff, but due to fuel burn, it will land lighter. Turbines also have the same power output from takeoff to landing because there's no drop in performance as a flight battery discharges. Oh, and they sound cool—REALLY, REALLY COOL!

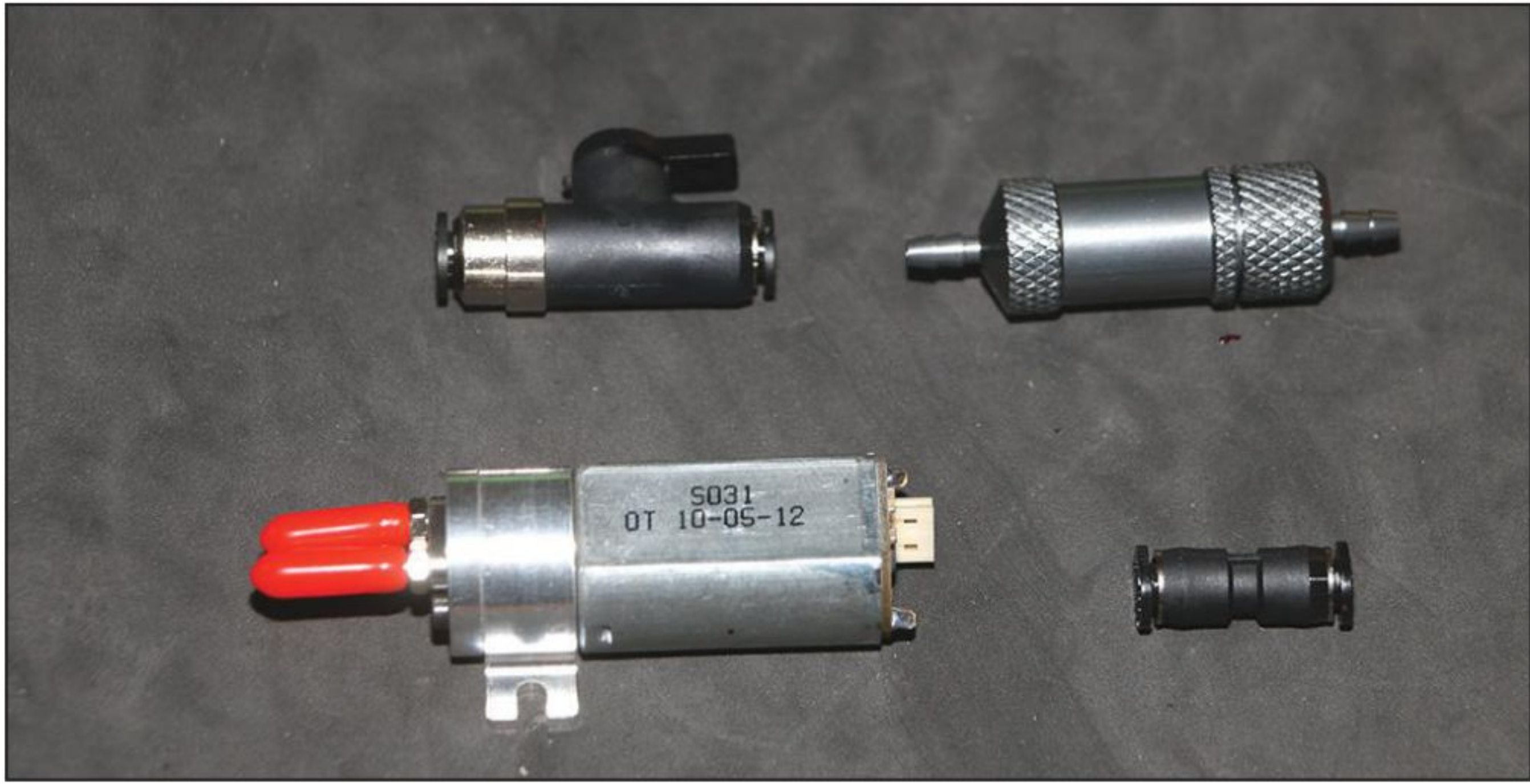
In the spirit of full disclosure, turbines also have some drawbacks. Cost is the primary concern of course, but turbines are getting more affordable. And don't forget that a good fan, speed control, and high C-rated battery setup isn't cheap, either. (And then you also need at least two sets of batteries so you aren't spending half your day watching a battery charger!) Also, if you're using AMA insurance you will need to qualify for a turbine waiver, which includes check flights, but that usually isn't complicated. Finally, if noise is a concern where you're flying, a turbine is significantly louder than an EDF. These factors aside, 8- to 10-minute flight times and fuel-fly-repeat convenience is hard to beat.

KINGTECH K-45G3

I have a lot of experience with KingTech engines, so when it came time to convert an EDF version of the Harlock RC Viper 140 to turbine power, I was excited to see KingTech had released a new version of the K-45. The Generation 3 (G3) is more than just an upgrade; it could almost be described as a new class of engine! I contacted Barry Hou at KingTech Turbines and arranged to buy a new KT-45 G3 and report my findings.

The K-45G3 is a kerostart engine, and the G3 version includes an integrated foreign object damage (FOD) screen. It is a 45 newton engine, but enclosed in a much smaller and lighter casing than its G2 counterpart. In fact, KingTech basically created an engine in a 30 N case that





Included with the K45G3 are a Festo fuel shut-off valve, inline fuel filter, fuel pump, and Festo 4 mm connector.



Touchscreen ground support unit (GSU), wiring harness, and electronic control unit (ECU).



One of the new features on the G3 is the integrated FOD screen to prevent ingestion of debris that can destroy the turbine blades.



So small it fits easily in the palm of my hand! This view shows both the glow ignitor used during startup to ignite the atomized fuel/air mixture, and the exhaust gas temperature probe.

produces 45 N of power. This makes the new 45G3 an ideal choice for 10- to 12-pound jets where space is a premium, as the weight savings will reduce wing loading or allow you to carry more fuel for longer flights.

Engine installation is highly dependent on model design, but speaking in general terms the 45G3 can be mounted directly to hardwood rails. Drill a pilot hole, harden the threads with thin Zap CA, and use self-tapping wood screws. The case on the G3 is so small that I had to extend the EDF mounting rails to accommodate the mounting tabs on the engine.

At first, turbine equipment installation may seem daunting. If you lay everything out on a workbench and get familiar with the way things go together before your hands are cramped and you can't see the installation, it will make more sense. Another unique feature of the G3 versus other versions is the single wiring harness from the ECU to the engine; previous models had a power cable and a separate RJ-45 equipped data cable. This new design creates a simpler and cleaner installation.

After I primed the fuel lines (running the pump test from the GSU until fuel reached the engine), the K45 started up on the first attempt. Spooling up and handover to the transmitter takes 45 seconds after initiating the startup.

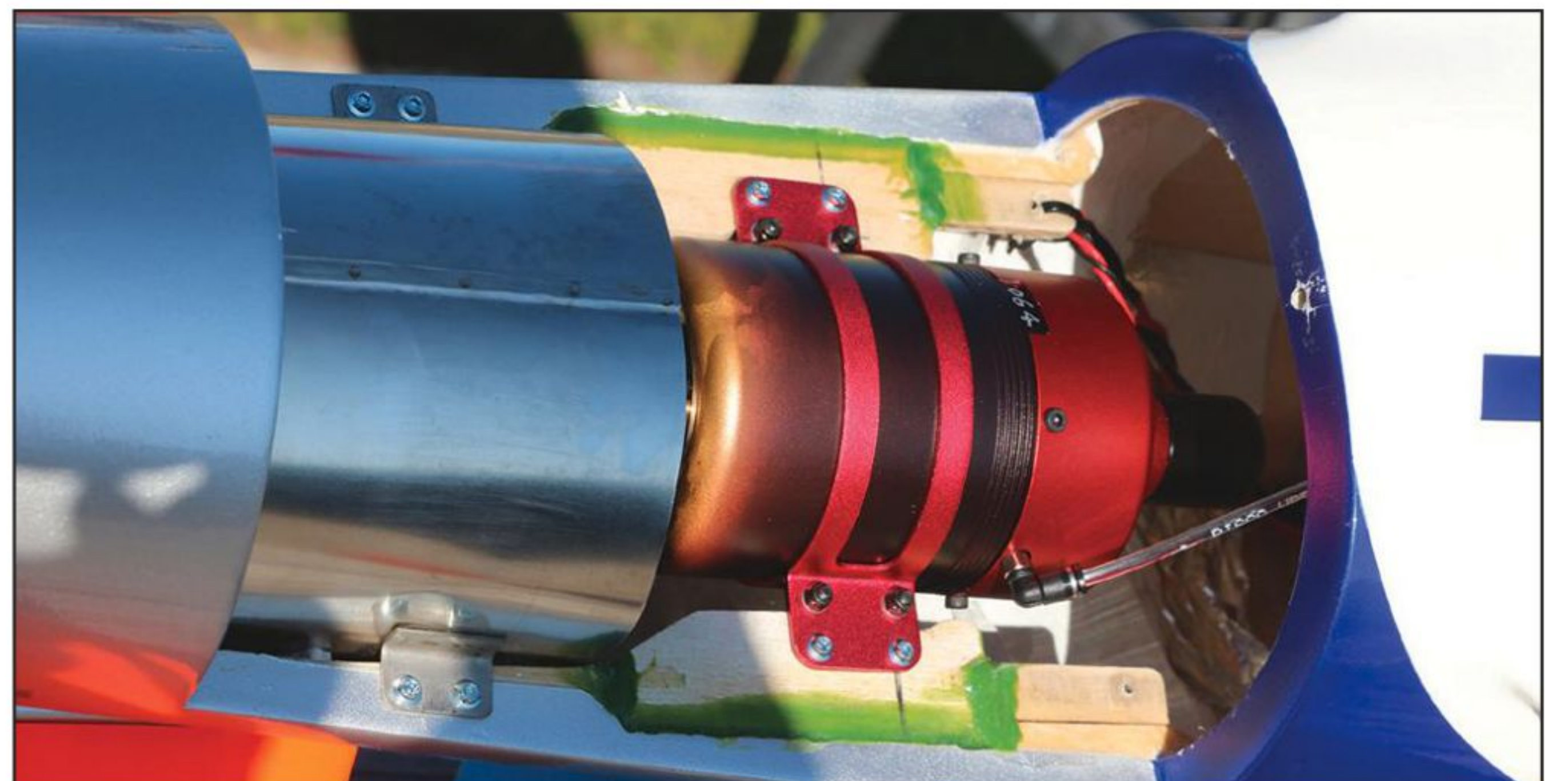
Throttle transition is smooth, and acceleration is good. Deceleration is a bit longer than I would like, and I've read that reducing the deceleration delay helps. I'll be experimenting with this carefully so throttling back doesn't kill the engine.

Fuel consumption is down from the G2 Viper, either because it's lighter and I'm using less throttle, or because the G3 consumes less fuel. Flight times are now pushing 10 minutes with fuel left in the main tank after shutdown versus seven minutes with some reserve fuel with the 45G2.

In the air, the 45G3 is as impressive as its predecessor but because it's lighter, vertical performance is better and landings are slower. A built-in FOD screen and lower weight with the same power as before means this little engine will be popular for both composite and foam jet conversions. Also, while no turbine is inexpensive, the price point of the G345 is appealing when compared to the other engines in this size range. KingTech also manufactures a 30 N engine with similar size and weight specs for even smaller jet models. ✈

Source

Kingtechturbines.com



The K45G3 installed in a Harlock RC Viper 140. The engine was small enough that I had to add hardwood mounting rails to attach the turbine properly.

TURBINE TERMS

ECU (electronic control unit): A device about the size of a receiver that plugs into the turbine engine, the fuel pump, and receiver (via throttle channel). The ECU is the brains of the operation and monitors critical turbine parameters like rpm, exhaust gas temperature, and more. The transmitter throttle control is sent to the ECU, which then sets the power to the engine by increasing or decreasing fuel flow at a rate that will adjust the thrust output without flooding, or fuel starving the engine.

ECU battery: Most turbines require an isolated battery to power the ECU and fuel pump. A 3-cell LiFe or A123 battery is the most common, and both are available from turbine manufacturers and other sources. Some engines include the ECU battery, some are separate. (Pro tip: For small 30- and 45-size turbine models, I use a 3S 1400mAh LiFe battery designed for airsoft guns. They weigh and cost half as much as batteries dedicated for turbines and they work perfectly.)

Flame out: A bad thing! You are directed to land Maverik, land immediately!

FOD (foreign object damage): When objects are picked up through the intake and make their way into the turbine compressor, they can damage the blades. A FOD screen is used to prevent objects going through the turbine.

Fuels: Most turbines will run on just about anything that burns, but the most popular are Jet A-1, kerosene, and diesel fuel. Lubrication is provided to the bearings by mixing the manufacturer's recommended oil type and ratio into the fuel, much like we do with 2-stroke gas engines. This is often dictated by what is available locally, but kerosene and pump diesel are just about everywhere. (Pro tip: Most lawn equipment and motorcycle shops sell a ratio cup that takes the guesswork



out of mixing oil into fuel in the correct proportion.)

GSU (ground support unit): A touch screen or LCD readout that plugs into the ECU and can be used to set turbine parameters, monitor startup and operation, and view logs or error codes from failed starts or previous flights. Some pilots mount these in the jet so they are visible through the canopy or with the canopy removed. With smaller jets I keep mine in my transmitter case and use as needed.

Kerostart: Refers to an engine being self-starting without the use of compressed air to spin up the engine or butane to get the fire lit. The start is managed by the ECU by controlling the fuel pump and burner and monitoring the temperature as the engine accelerates to idle speed.

Residual thrust: This is the output of a turbine engine at idle. It comes into play during landing, using a larger than recommended engine for a model results in excess residual thrust that affects landing speed and is akin to a propeller plane trying to land at a high idle.

Turbine lag: The time difference between making a power change at the throttle stick and the time the turbine, and subsequently the model, reacts. Turbine engines take more time to both accelerate and slow down and this

causes some pilots, especially pilots of EDFs accustomed to instant power, to get behind when they're flying a turbine-powered model.

Turbine sizes: Most turbines express their size in newtons of thrust output. An example is our review subject, the K-45, which outputs 45 N of thrust, or a little over 10 pounds. An engine with a number in its name usually refers to its newton output. Otherwise, check the specs so the output matches the model.

UAT (ultimate air trap): These appear under various names, but their purpose is the same. A small fuel header tank with a special fuel pickup is used between the main tank and the turbine to trap air bubbles before they reach the turbine and put the fire out. Some pilots use a felt weed whacker pickup in the tank on small models to eliminate the cost, weight, and room a UAT takes up.

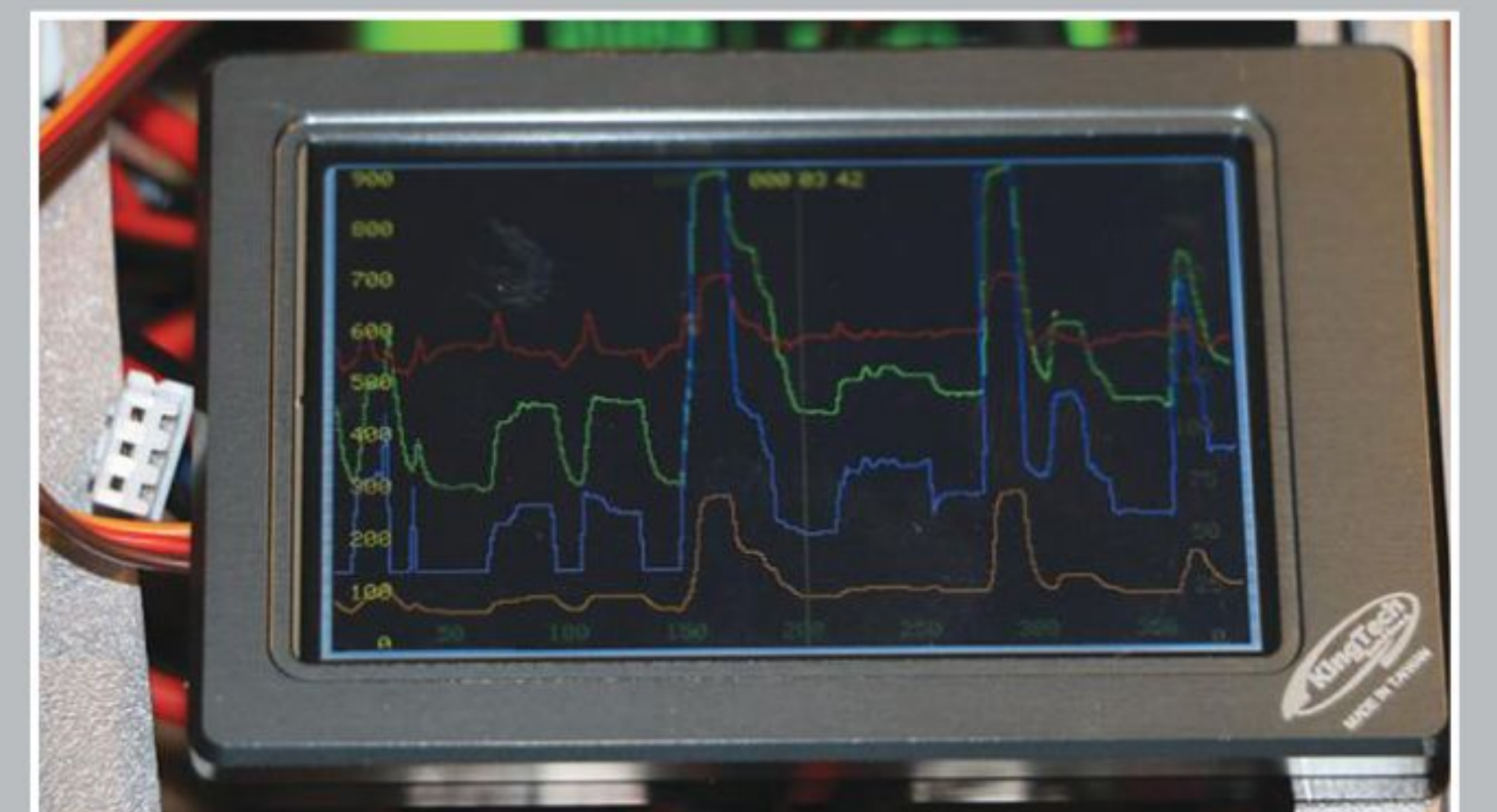
Turbine waiver: An endorsement from the AMA that shows that a turbine pilot has demonstrated certain knowledge and skills to a waiver holder and a contest director with wavier; required to fly at AMA events and for insurance coverage. I have helped pilots who fly electric ducted-fan jets (EDFs) get used to the transition by using the servo speed feature in their transmitters set to 2.5 to 3 seconds to simulate lag.



There's a lot going on in a turbine jet, but once you work your way through your first install things start making sense. Having an experienced jet pilot inspect and critique your installation goes a long way toward success.



The GSU is the operator's interface to the turbine. This is the home screen and shows ECU battery voltage, turbine status, rpm, exhaust gas temp, and other details. Much of this information can be sent to telemetry enabled transmitters, like my CORE or DX-20, with the proper onboard module.



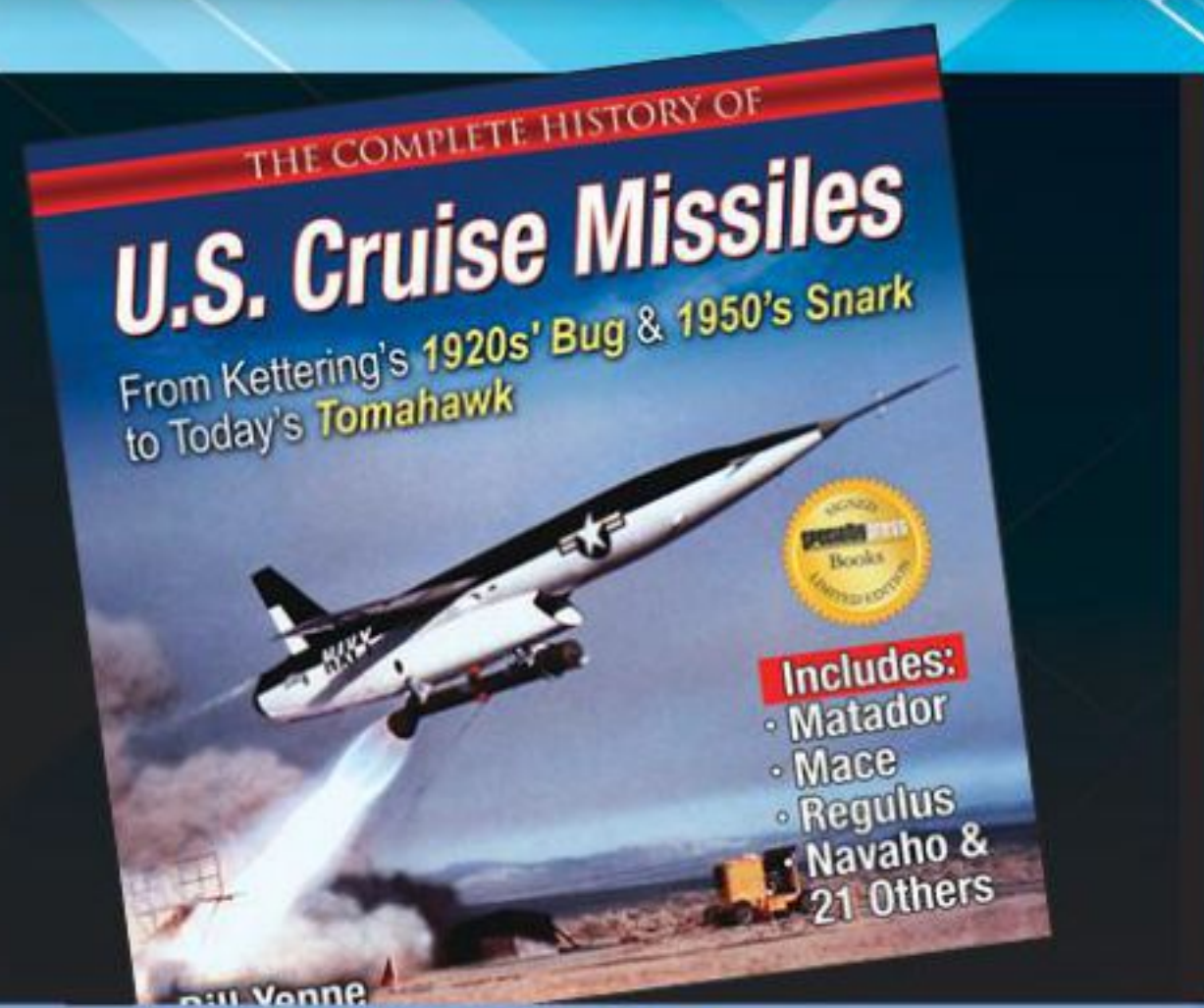
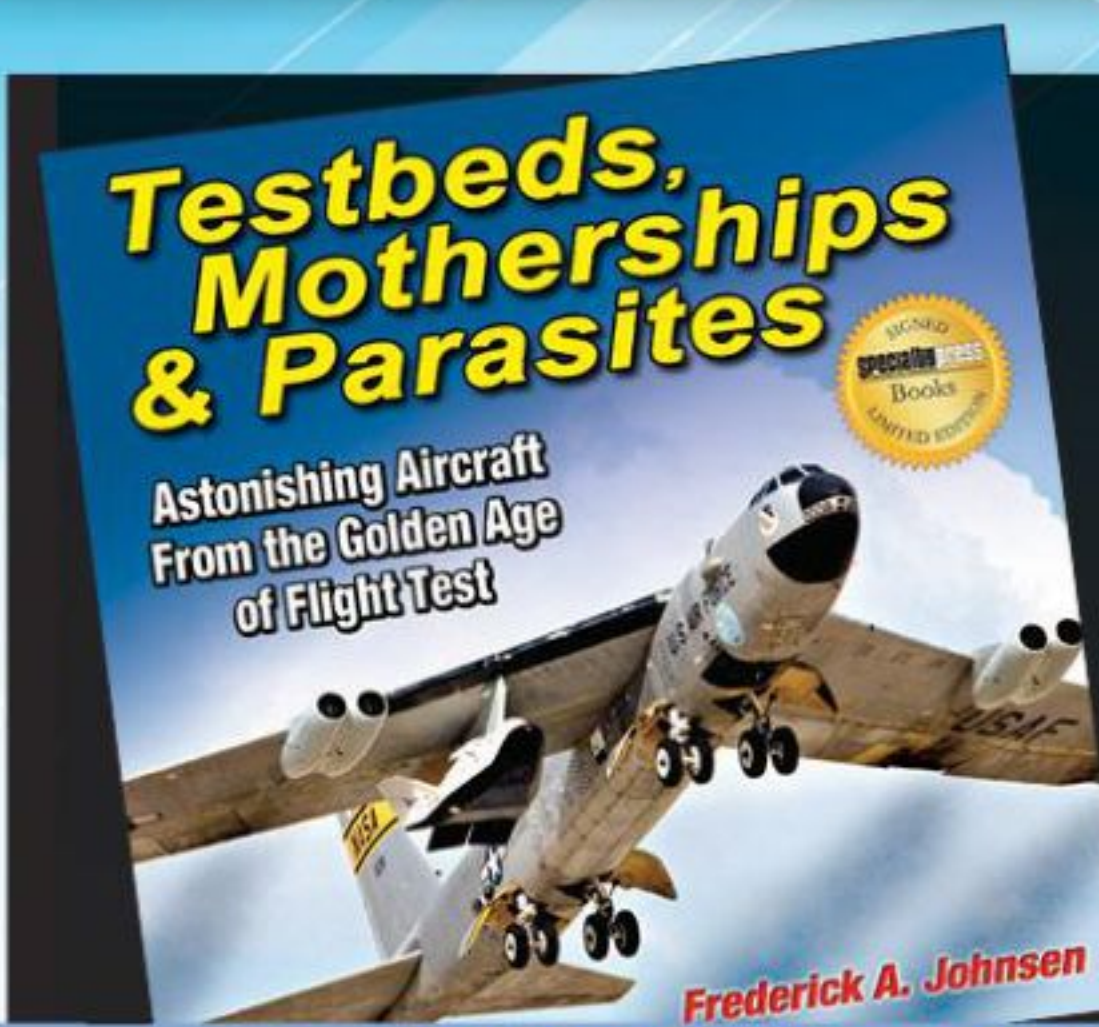
The GSU can read logs from the last few flights from the ECU if analysis is necessary for tech support.

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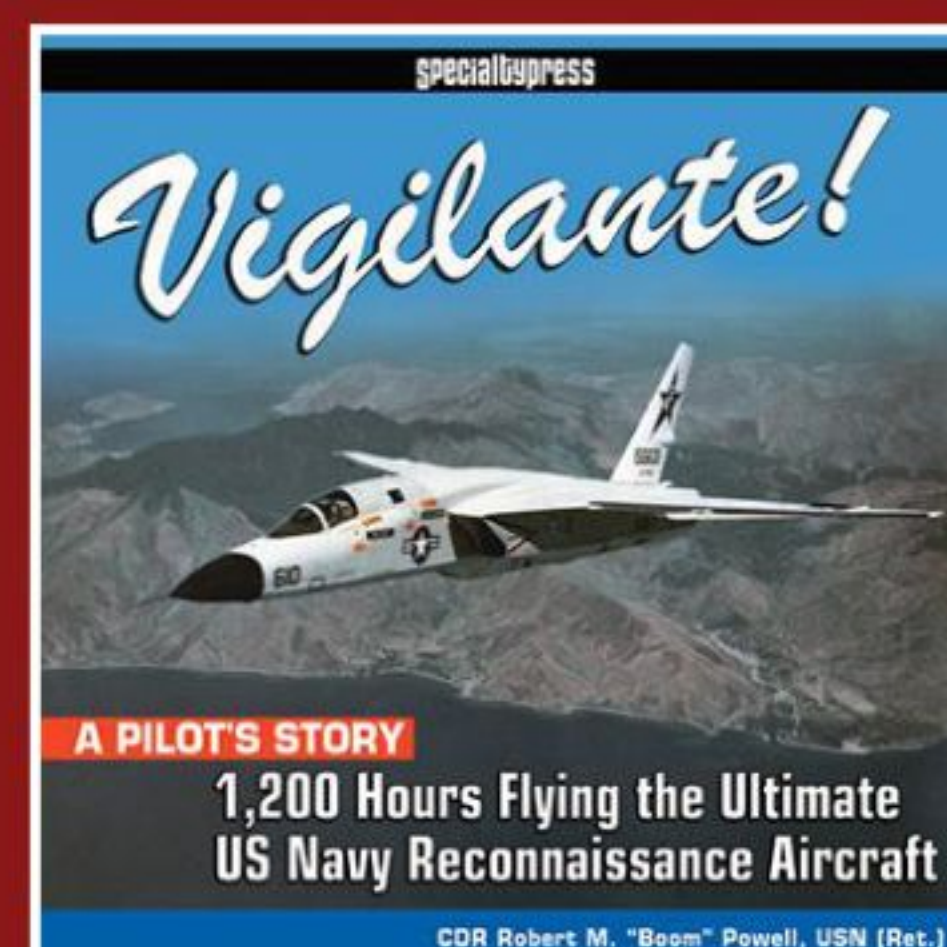
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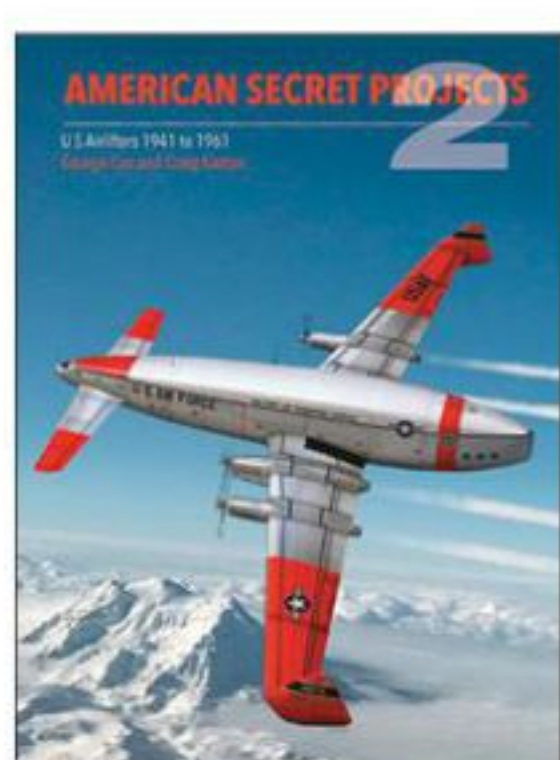


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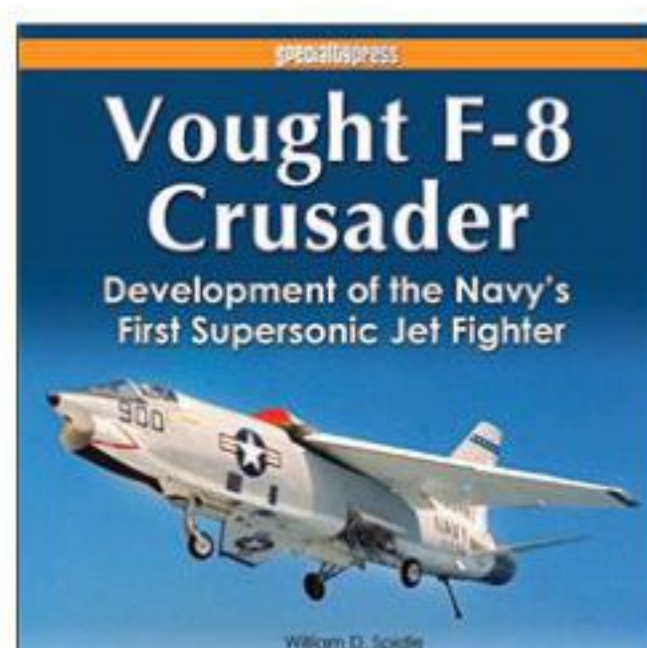
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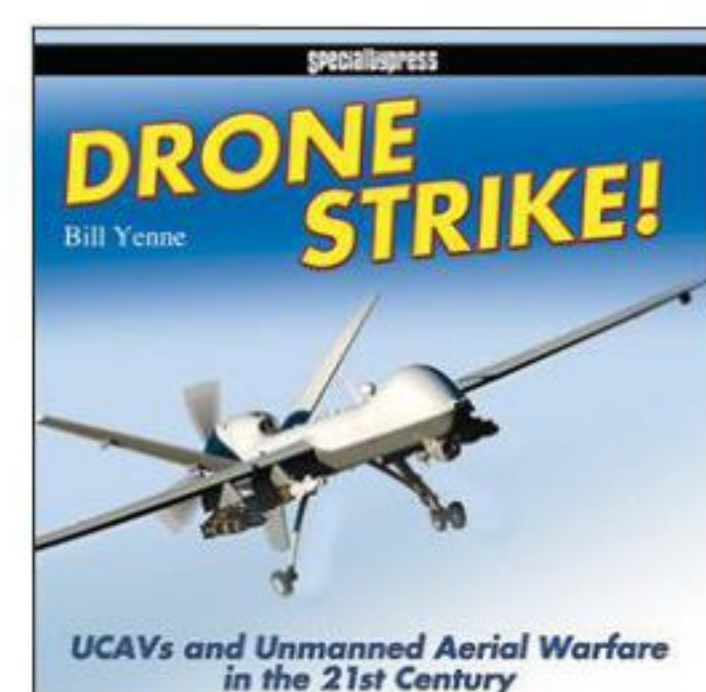
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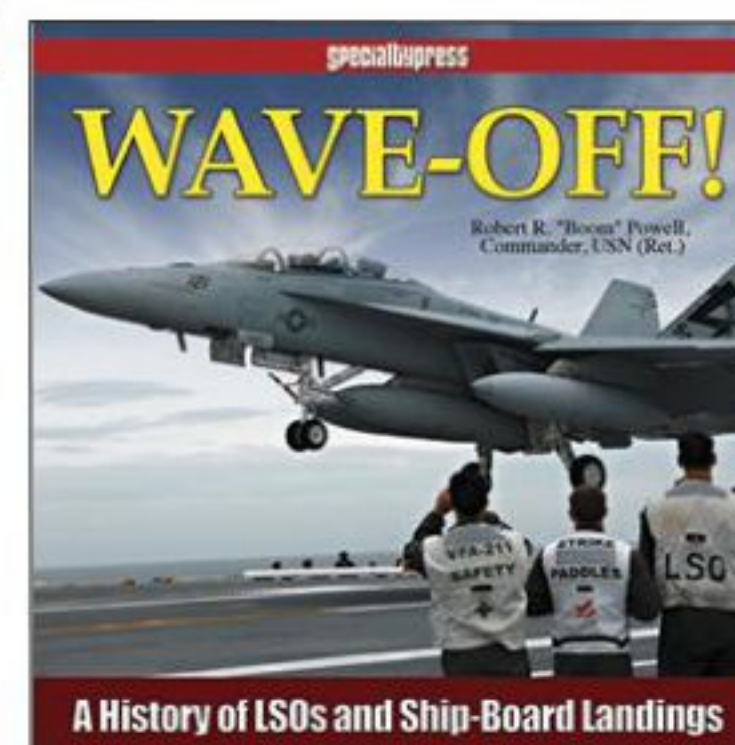
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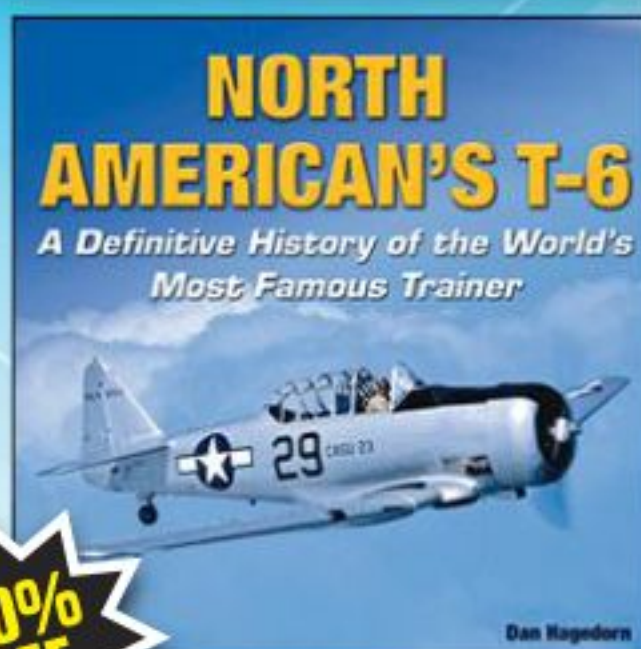
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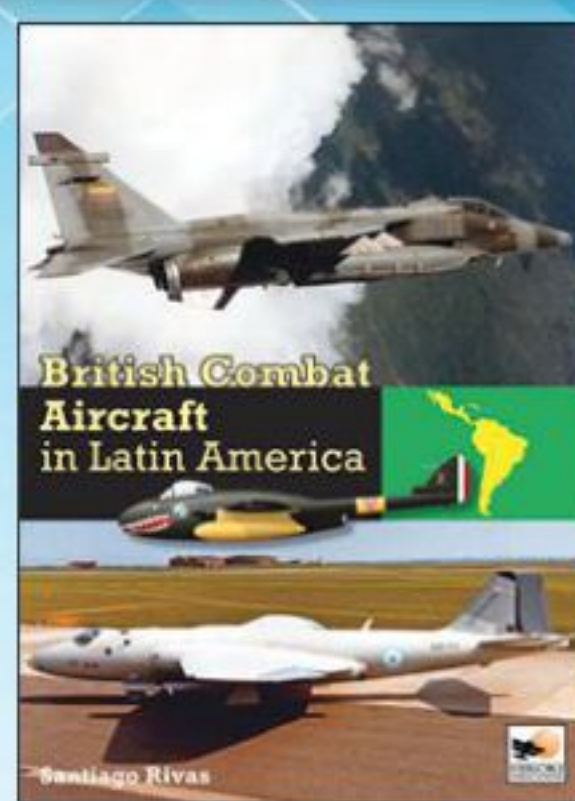
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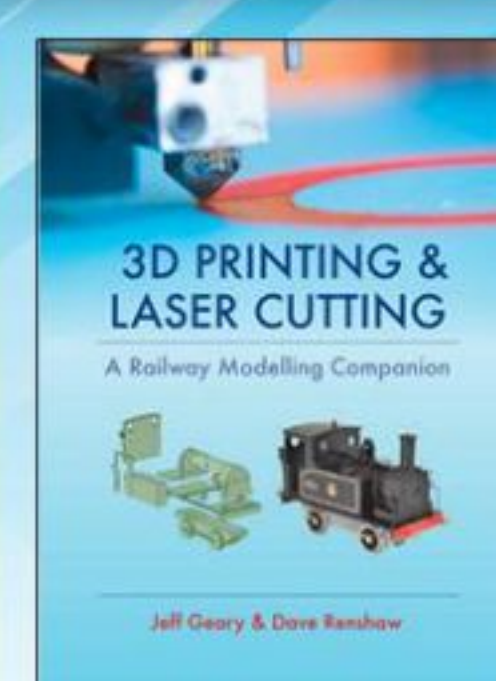
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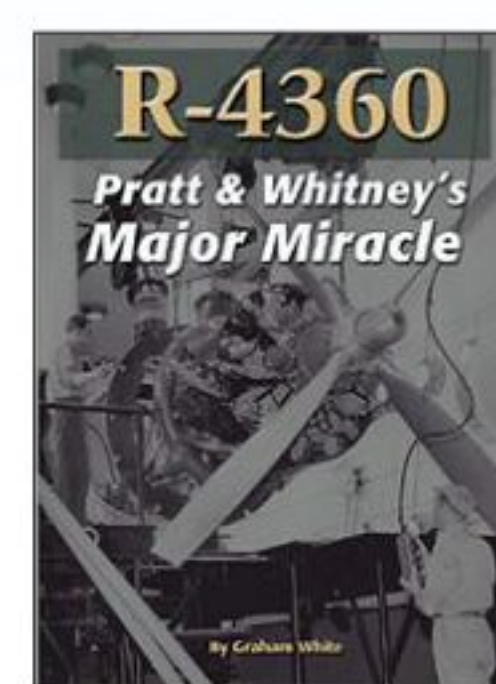
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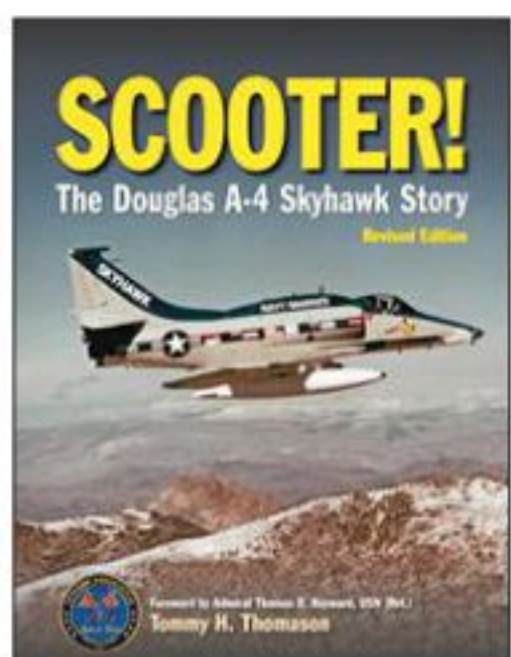
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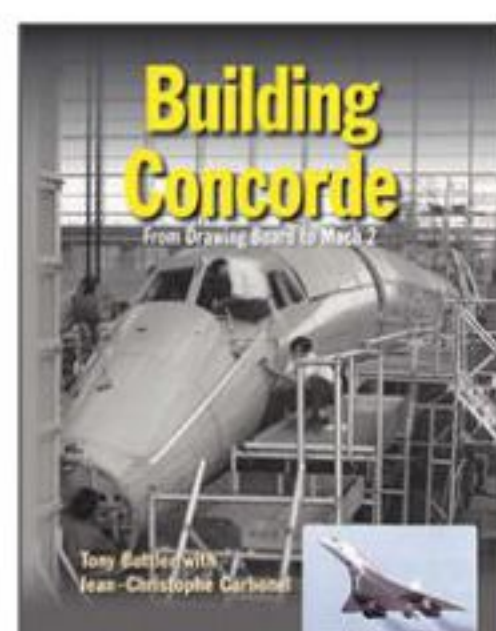
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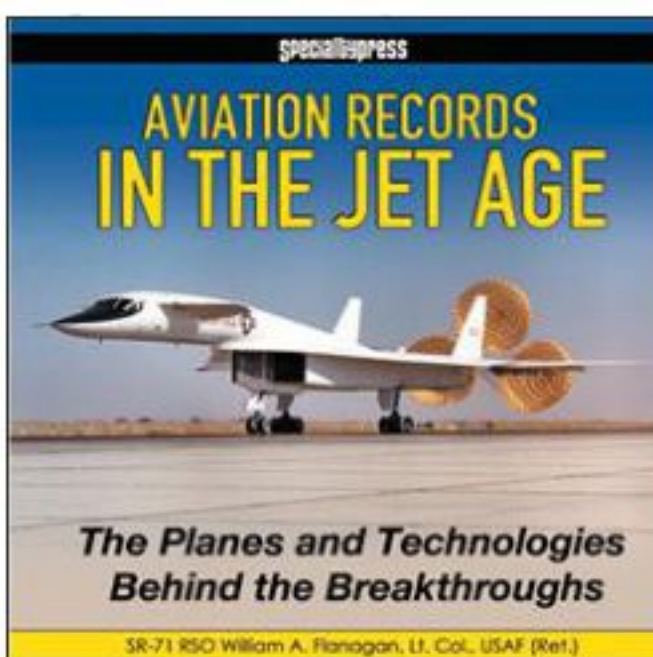
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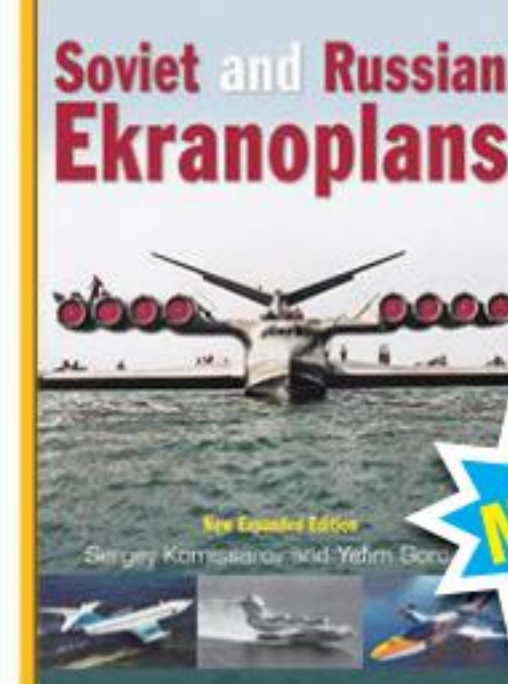
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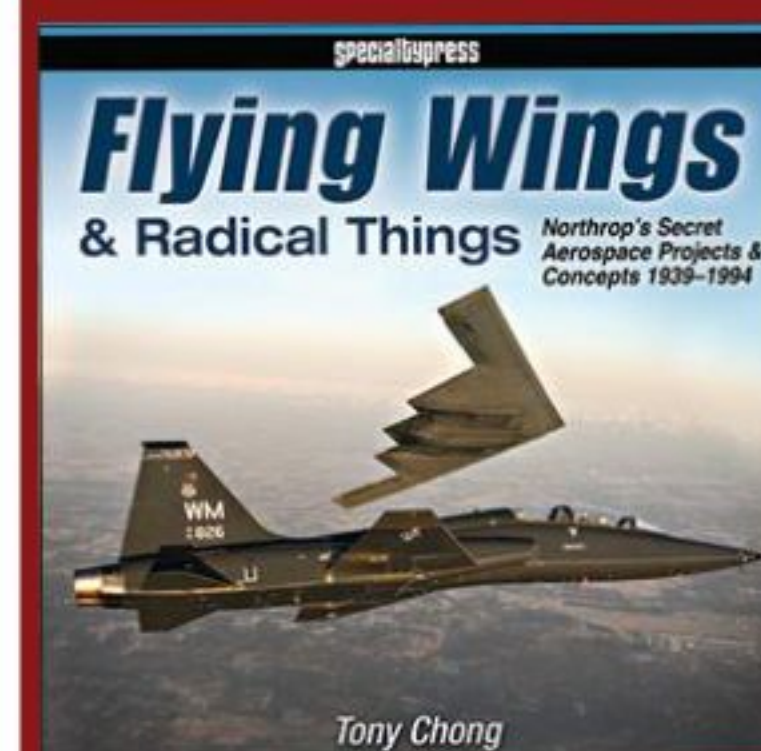
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One of my favorite warbirds from last year was the E-flite P-39 Airacobra. It is a great flier, but unfortunately, this one did see its share of abuse.

MODELING TIPS FROM THE WORKSHOP

Easy warbird repair tips and tricks

Welcome to the RC Geek! I am a full-time aerospace engineer from Southern California, and I've been into the RC hobby for most of my life. I also have a website and a YouTube channel called the RC Geek. My goal from Day One has always been to demonstrate building techniques, share products I enjoy, and feature incredible scale models that I find while attending RC events. My goal is to help fellow enthusiasts while promoting this hobby I enjoy so greatly. Personally, I love building and flying all things scale, and have even competed nationally in the U.S. Scale Masters Association Championships. This new addition to *Model Airplane News* will touch on anything and everything in RC. So let's begin!



The airplane unfortunately ended up crashing upside down in some weeds during a photo shoot.



Here, you see some of the crinkles that have formed on the fuselage's nose resulting from the crash. Start the makeover by removing the propeller and spinner, then take the rest of the airframe apart.



A dent in the wing's leading edge. This will be easily taken care of with some lightweight spackle filler.



The aircraft hit the ground inverted, so the vertical tail took the brunt of the damage.



Minwax Polycrylic is a great sealer for use on molded foam airplanes. It helps seal and stiffen an EPO foam airframe.

One of the questions I often get is, What's on your workbench? Sometimes it's a crashed airframe, which can actually be a gem, as it can then be used to demonstrate repair and refinishing techniques. And that's what we have here.

FIXING A FOAM FIGHTER

Sometime ago, a friend crashed my E-flite P-39 Airacobra while we were attempting to take pictures for a review. Being such a nice flying model, I opted to breathe new life into it and give it a full makeover.

First, of course, I took it apart and masked off the clear canopy sections with 3M Fine Line and painter's tape. I then started the refurbishing process by filling in all of the panel lines with lightweight spackle filler to smooth out



After a good cleaning and a light sanding with 180-grit sandpaper, apply some spackle filler to fill the damaged areas and molded-in panel lines.

the airframe. Once the filler had dried, I followed up with some sandpaper. Next, I applied about four coats of Minwax Polycrylic to seal it all up. Water-based Polycrylic is available at home improvement stores, and is mostly used to seal and protect wood floors and other household surfaces. I used it to seal and stiffen the P-39's molded foam airframe. It's very convenient since you only need water for cleanup.

To get the model paint ready, I put the airplane through my usual prime-sand-and-prime-again process to smooth out the surfaces and eliminate any foam texture. Nothing fancy needed here; EPO foam is extremely resilient and will handle all sorts of paint mediums. I just used Rust-Oleum automotive primer in a spray can. To get a really smooth finish on a foam aircraft you can't just add a thick coat of primer. It requires multiple light coats of primer, each of which is then

■ THE RC GEEK: MODELING TIPS FROM THE WORKSHOP



Fill in all the panel line details with filler. Let it dry and then sand it off with 180-grit sandpaper. Filling in the panel lines results in a more realistic looking smooth airframe



An old playing card or a piece of cardboard makes a handy squeegee to apply the filler. Notice that I also removed the decals from the wing. These areas will also be treated with filler and sanded smooth the same as the rest of the airframe.



The wing with primer added. After several light coats of primer have been applied, you'll add a final coat of primer and wet sand with 600-grit sandpaper for a really smooth finish. The far wing panel has been painted with a final primer base coat prior to wet sanding.



The P-39 with its new paint job— nice and smooth and better than new!



Here you can see that there is no sign of visible damage on the tail surfaces.



When you do your makeover, the sky is the limit when it comes to new aircraft markings, so research and have fun! These great graphics are from Callie Graphics, and they offer lots of authentic graphics to choose from.

allowed to dry before being sanded nearly completely off. This process gradually fills in the surface. After several coats of primer, sanded with 180-grit sandpaper between each coat, you will build up a smooth surface. Take your time, there's no substitute for sanding. The goal here is to produce a good base for painting. To finish, the airplane needs to be wet sanded with 600-grit sandpaper for a really smooth surface.

I painted on the colors using Tamiya Spray Paint, available in many authentic military colors. I chose Neutral Gray and Olive Drab (OD) for the Airacobra's makeover. I next applied some

stick-on vinyl markings from Callie Graphics, and then added some basic panel lines using a mechanical pencil. The end result is fantastic and provides a much more realistic look.

Well, that's it for this geek adventure. My P-39 is going to have more improvements, including a full weathering workup, which we will touch on in the next issue of Model Airplane News. Until then, I'll see you at the field!

[To see what's going on in Chris' workshop, check out his website: thercgeek.com, and his video channel: [youtube.com/thercgeek](https://www.youtube.com/thercgeek). He's also on Facebook, Instagram, and Twitter.] ±



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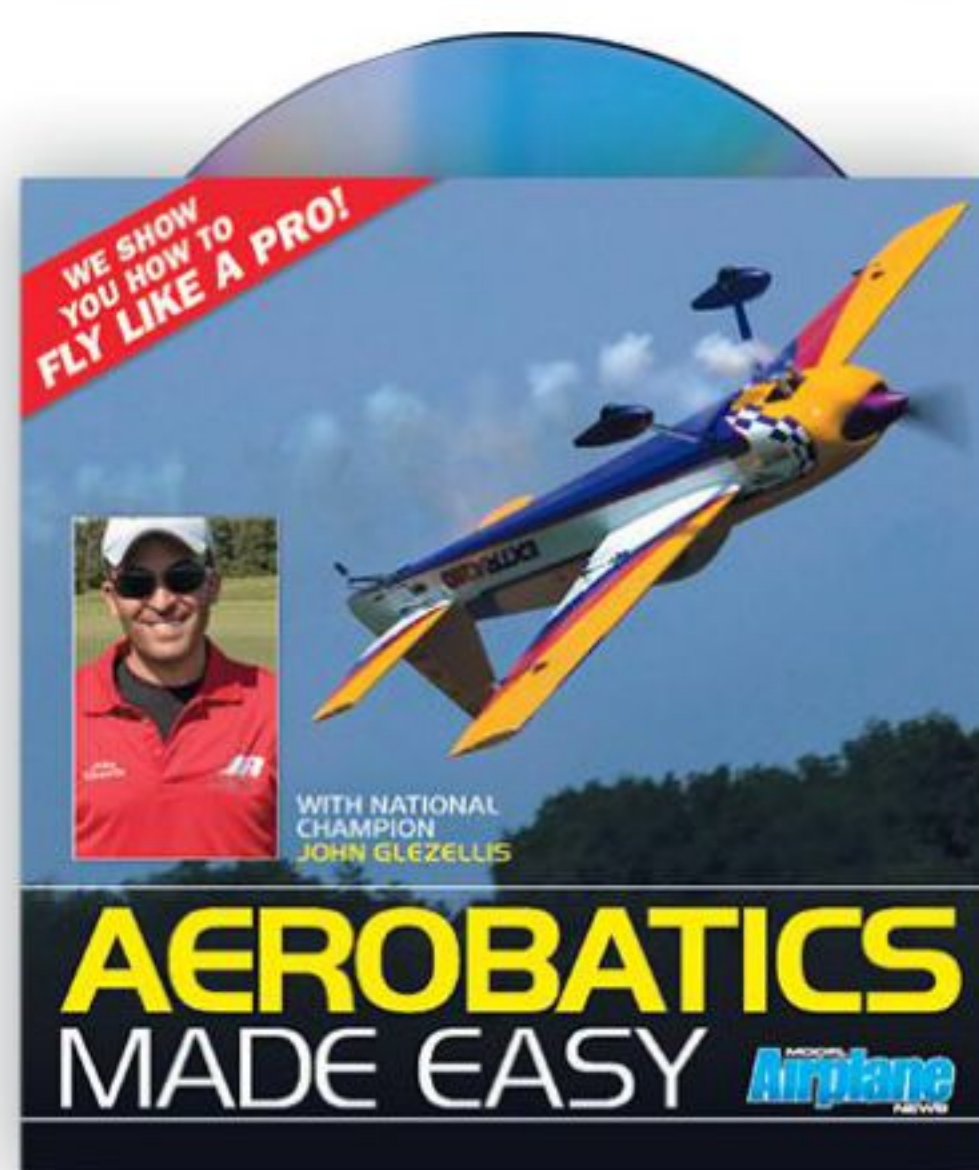
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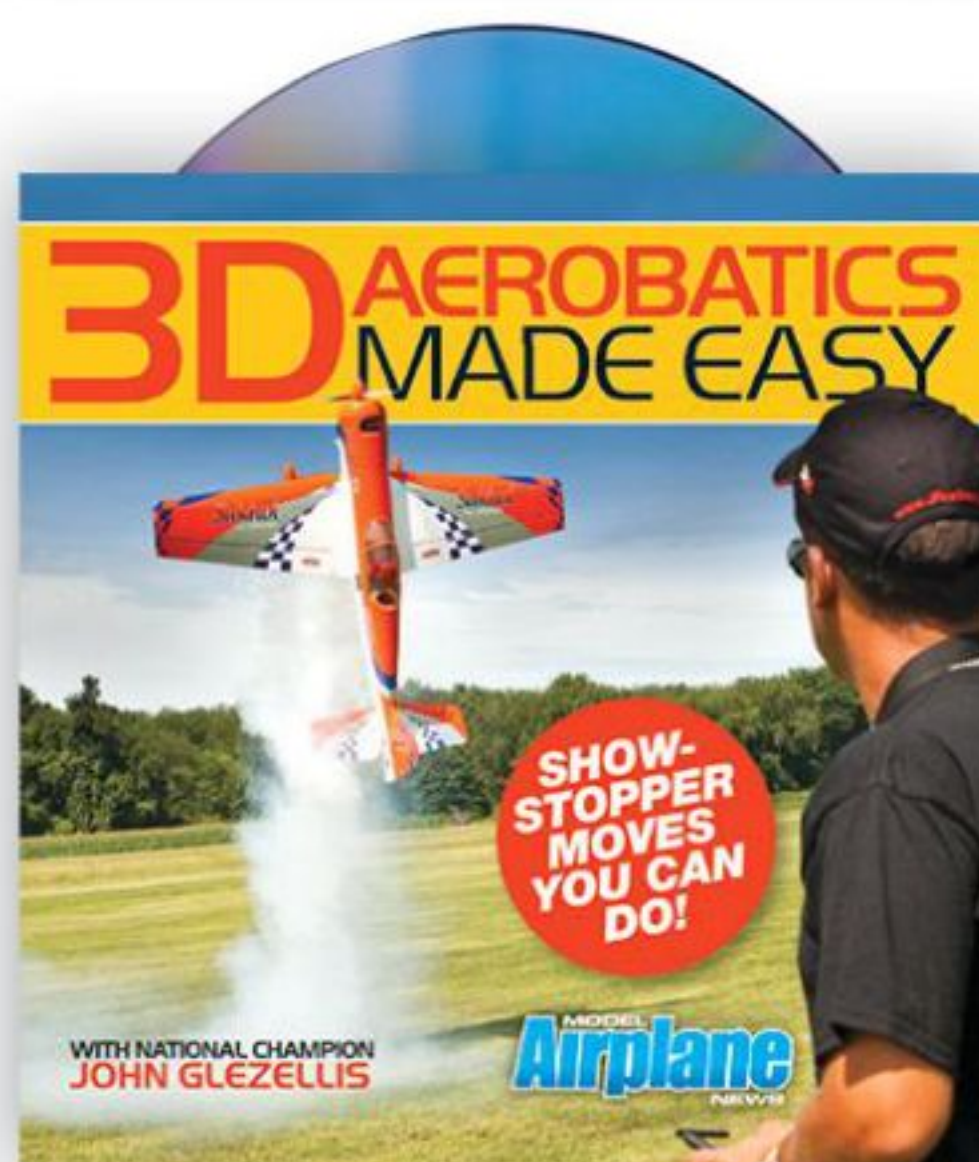
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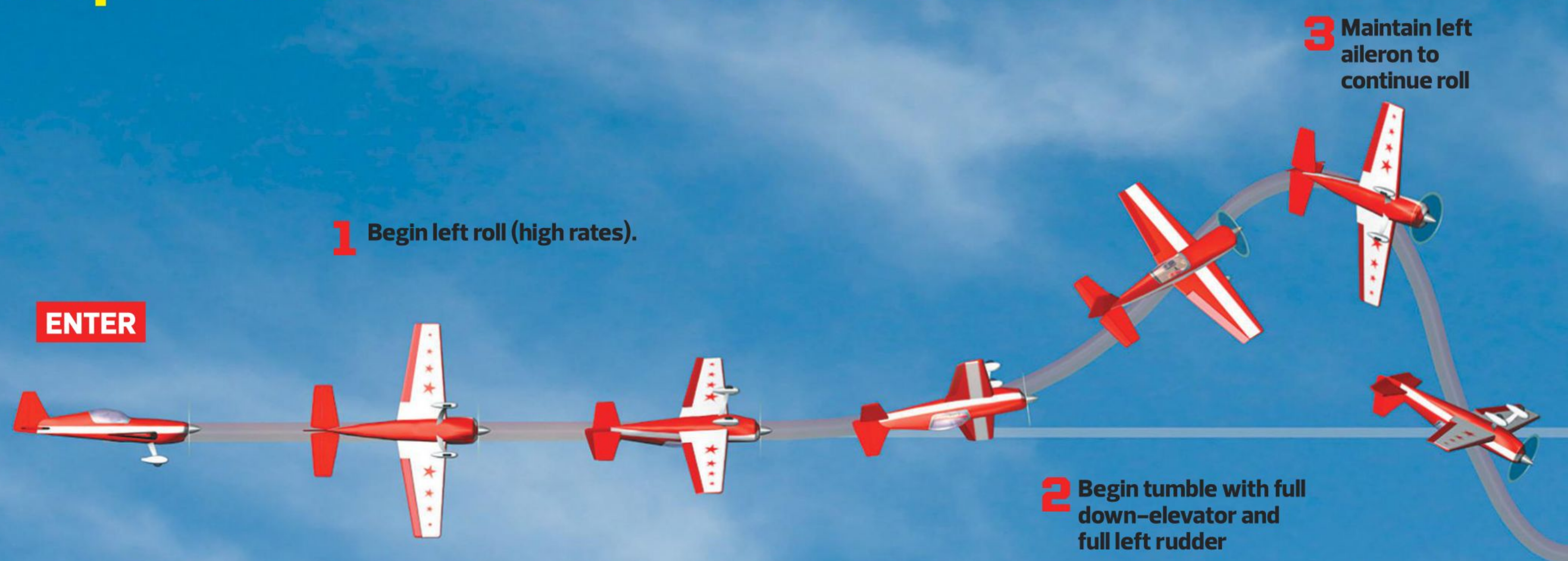
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FLY THE ROLLING TUMBLE

An impressive move to wow the crowd



The rolling tumble is an impressive 3D maneuver, and while you're learning, it's important to break it down into short segments. Before you attempt it, make sure that you are proficient with rolling at a fairly fast roll rate. Also, make sure that you know how to perform a typical tumble. Let's start by refreshing your memory on the basic tumble.

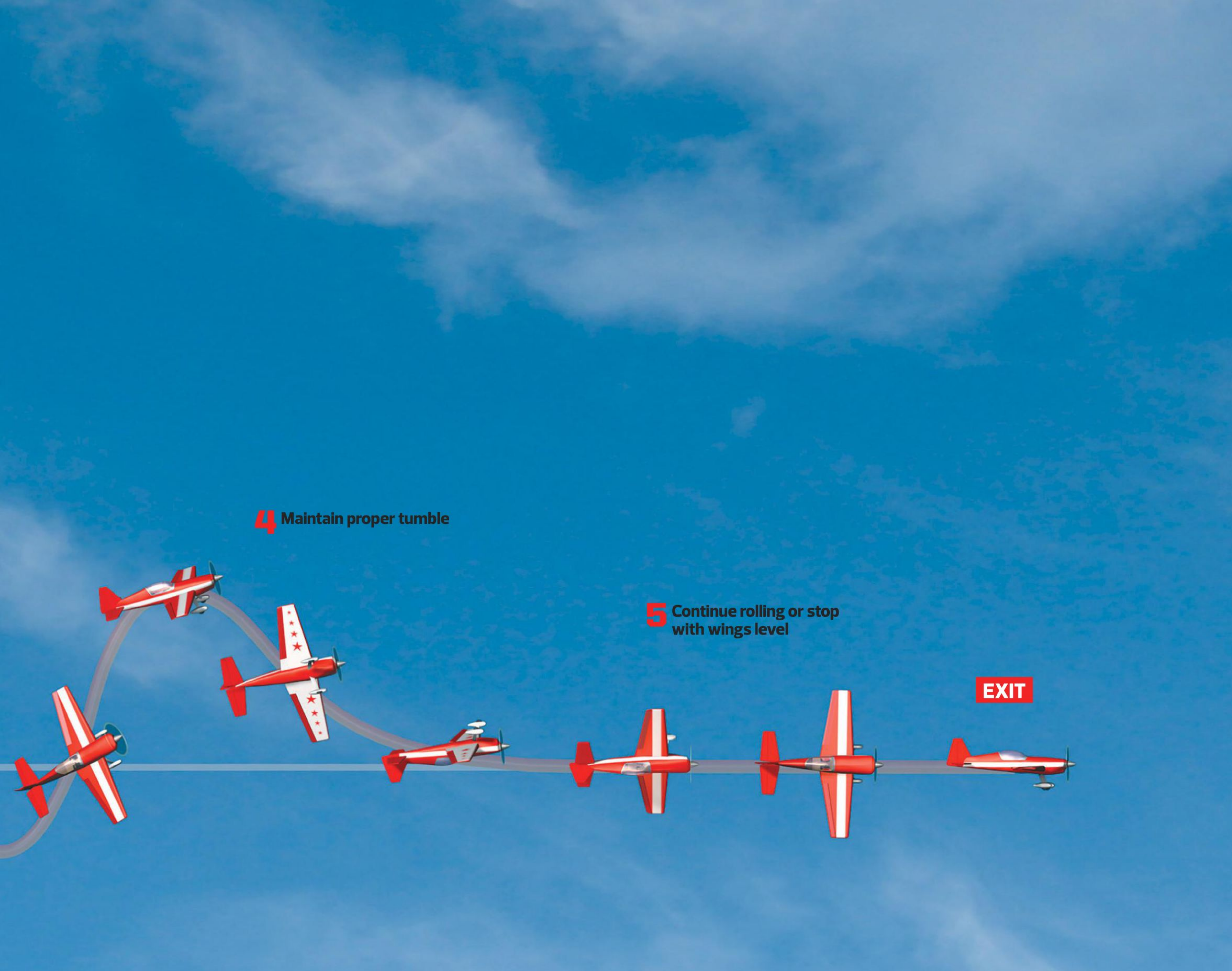
Begin by flying to a significant altitude, parallel to the runway, and pull your model onto a 45-degree upline. Then, switch to your high-rate setting (for the aileron, elevator, and rudder control surface) and apply down-elevator and the same direction for rudder and aileron. For example, to perform a tumble to the left, add down-elevator, left aileron, and left rudder.

To perform a rolling tumble, you must fly to a fairly high altitude, parallel to the runway. When you've established this flight path, fly the model at a moderate flight speed and then begin rolling the airplane. After every roll is completed, apply the inputs for a tumble (in the same direction of the roll). Aileron input should remain constant, as the model should not stop rolling, even after a tumble is completed. When you want to finish the maneuver, simply stop the model's roll when the wings are level relative to the horizon to exit upright.

FIRST THINGS FIRST

We've already established that in order to master the rolling tumble, it's essential to become proficient with rolling quickly while maintaining the same heading. Simply put, the model should track as if it were on a string from one end of the flying field to the other while rolling. Throughout this maneuver, you'll use maximum control deflection on the rudder surface. To ensure success, you should be aware of the proper implementation of 3D rates. This is another way of expressing rate values with maximum control surface deflection (plus or minus 45 degrees of deflection). While extreme amounts of aileron and elevator deflection are not critical for this maneuver, rudder deflection is. When using 3D rates, I highly recommend that you use a lot of exponential on a control rate that's above 30 degrees of deflection. Exponential is an adjustment to the actual curve of how the inputs are given to the servo. A value of 60 percent expo will ensure that your model is fairly precise around neutral stick and that your extreme endpoint value will be obtained when the control stick is at its maximum point. By using a greater amount of exponential on high rates, your model will react the same way it does on low rates when the stick nears center.

To successfully fly the rolling tumble, it is preferable to



have a model with really large control surfaces. Always remember that the difference between a good flying aerobatic model and a great one is in the design of the aircraft. Models with a rather light wing loading and a high power-to-weight ratio usually fly better. Now let's discuss the five steps to performing this show-stopping move!

FLYING THE ROLLING TUMBLE

This maneuver requires that you establish a flight path that is parallel to the runway at a fairly high altitude. If you become disoriented, you can safely recover. Remember, this is a complex maneuver, and some models may react differently to the control inputs that are needed.

1. To begin, use a moderate throttle setting and make sure that your model is on high rates for all control surfaces (aileron, elevator, and rudder). Then, begin rolling your model to a particular direction. In this example, we will roll the model to the left.
2. When your model is in the inverted position (for example, once the model performs one and a half rolls from upright level flight to inverted flight), you'll need to apply full down-elevator and full left rudder (if the model is rolling to the right, apply right rudder). If done properly, the model will perform a tumble.

3. Remember that the model should never stop rolling. With that said, always keep the aileron input constant. Once another roll is completed, perform another tumble.
4. Keep in mind that different models will perform this maneuver with some variation. If you input too much down-elevator, the model might perform a maneuver that looks like a positive gyroscopic maneuver. Do not mistake this for a tumble. If your model exhibits this, use less elevator input.
5. To exit the maneuver, you can either continue rolling, or stop when the wings are level relative to the horizon in upright level flight. Mission accomplished! Give it another shot, as practice makes perfect.

These five steps are the basics to performing the rolling tumble. I urge you to never become discouraged when trying a new aerobatic maneuver. If you are finding this maneuver difficult to perform, review your plane's setup. For example, if your aircraft rolls too quickly and you can't apply the needed inputs to maintain proper heading, then decrease your aileron travel rate (in other words, decrease your dual rate value). And above all else, always remember to have fun! ✚

TEXT & PHOTOS BY DAVE PATRICK

Dave's Secret Sauce

Dual rates, expo, and more



Today's radios are first-rate, and modern servos are superb, so we pilots tend to cover up some sins through modern technology. The truth is, to fully benefit from our super radios we need to start correctly with the basics. The concept I outline here works on any setup: scale, IMAC, jets, you name it. Start with these steps, and then you can season to your individual taste!

Step One: Crank Up Your Transmitter!

In your transmitter, start with at least 125 percent on all throws—even throttle! I use minimum of 130 percent on my JR. Using less reduces system resolution and torque. Don't give away your newfound advantage!

Step Two: Read the Manual for Your Aircraft

Always start with the manufacturer's recommended throws for your aircraft. In fact, I start with a little less—never more. More gets you into trouble, not out of trouble. The difference between full optimization and "it works fairly well" is not subtle.

Step Three: Use the Longest Horns

Use the best, longest, and stiffest control horn on every control surface. If you need more throw, do not go "in" at the control horn; always go "out" at the servo horn, even if it means buying new servo arms.

Step Four: Dual Rates and Expo Settings

I like to start with three rates: 100 percent high, 70 percent medium, 55 percent low. I use the same settings on aileron, elevator, and rudder.

With expo, the idea is to make the controls feel softer around neutral. Some manufacturers use negative values, some use positive. If you are not sure, use a high number, such as 90 percent, to see which gives you soft centering.

Here is where setup becomes a little tricky. Higher rates need higher expo values. For a start, try using 50 percent expo on high rates, 33 percent expo on medium, and 25 percent expo on low. Helpful hint: Move the stick about 25 percent and cycle through the three rates. There should be almost no movement on the control surfaces. Doing this will give you the same feel of the airplane around neutral on all three rates. When you go past that stick deflection, you will get that selected rate.

Yes, the same rule applies to throttle. Resolution is extremely important on throttle. Most throttles benefit from some expo to give a linear transition (i.e., not too sensitive just above idle).

Be safe, and I hope you enjoy my "secret sauce"! ✈



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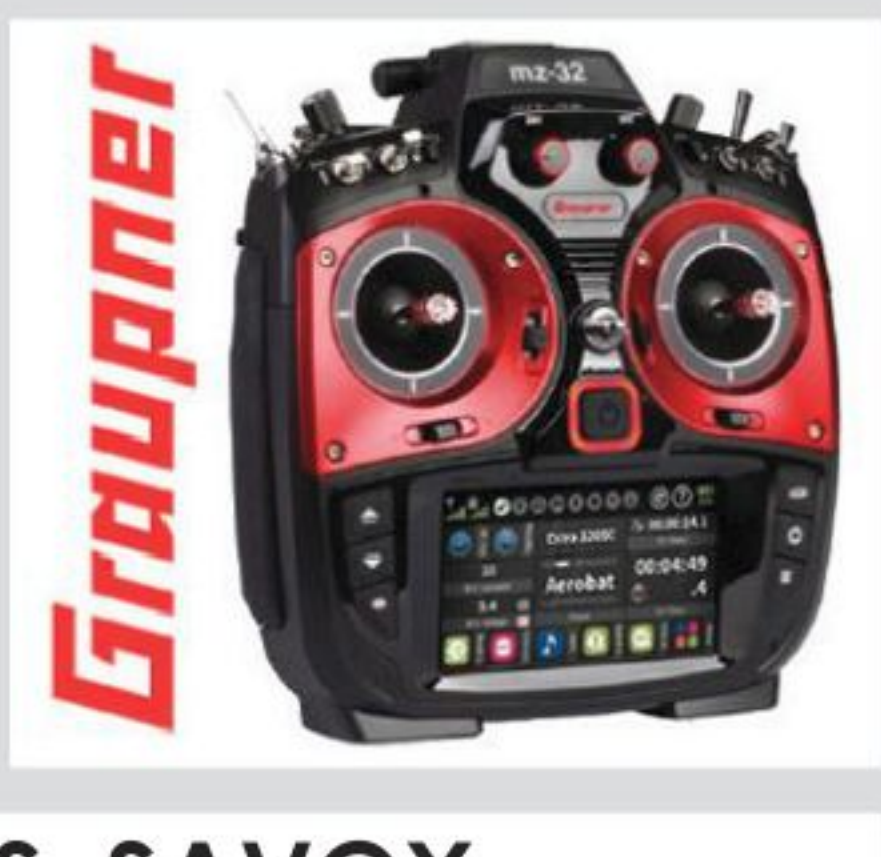
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