BY DICK SARPOLUS

RACK UP KILOWATT-HOURS AT THE FIELD WITH THIS RC SPORT TWIN

Lotsa Watts

The author holds his man-size design. It is easy to construct and has pleasing lines both on the ground and in the air.

TWIN-ENGINE airplanes are fun, larger airplanes are fun, and I've been enjoying electric-powered flying, so here's the Lotsa Watts. It's a big, double-motored aerobatic sport flier that is easy to build and fly.

Twin-engine flying is fun to the point where through the years I've had many of these types of models and continue to consider them for future projects. I started this design because I wanted a bigger electric-powered airplane, but I didn't want to spring for a huge motor, ESC, and battery pack.

I already had a good 45-size electric setup, so figured I'd duplicate that system and the power of two 45s would enable me to fly an 82-inch-wingspan aircraft with lively performance. Those two propellers would make for extra excitement and fun. It worked out well.

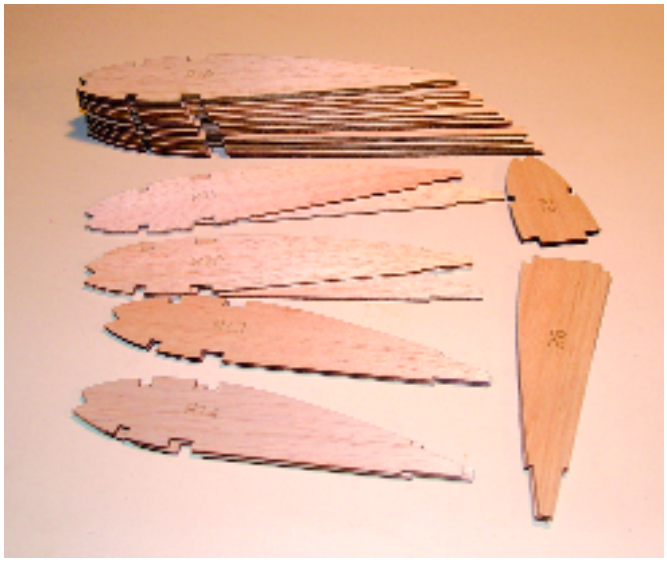
I wanted to make an airplane that would span more than 80 inches—the IMAA's (International Miniature Aircraft Association's) definition of a "big model"—so it would be eligible for its fly-ins. I figured two glow .45s would do the job, so I compared them to the electric components. I estimated that a glow .45, muffler, engine mount, throttle servo, and fuel tank with the fuel would weigh at least 36 ounces.

The electric motor I wanted to use, roughly equivalent to a glow .45, with an ESC and five-cell Li-Poly battery pack would weigh approximately 32 ounces. I could go electric with no problem and saw no reason to try really hard for an extra-light airframe.

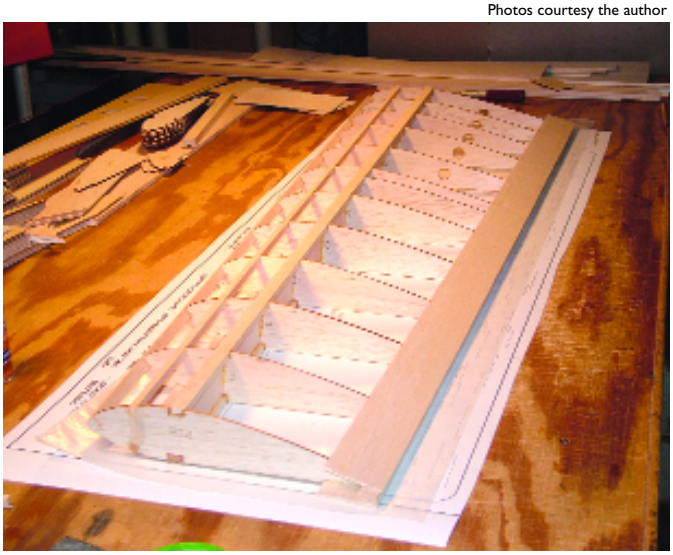
Not so many years ago, to go electric and get the performance of a glow engine meant building an exceptionally light airframe. With today's electric-power technology, there's no longer a weight penalty in this size range.

With the absence of engine vibration, an airframe structure for electric power can actually be a bit lighter. If you really like the glow engines' sound and oil, throw a pair of .40s or .45s on the Lotsa Watts for some noisy fun.

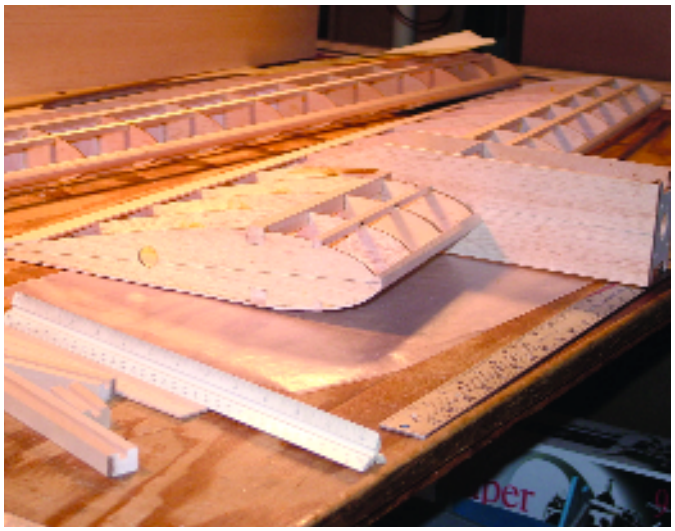
Photos courtesy the author



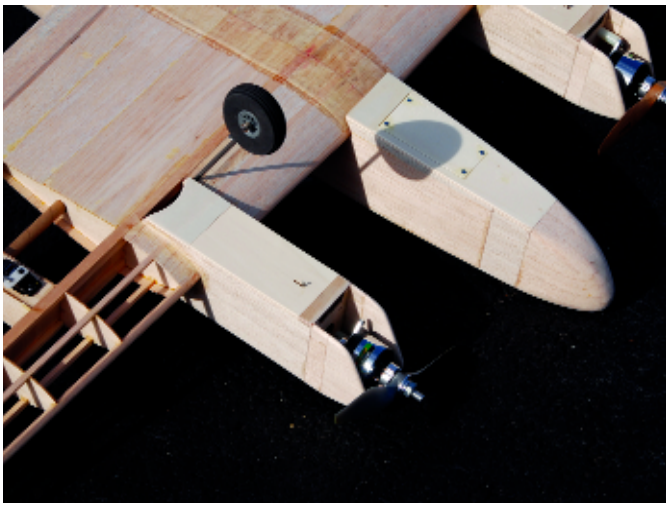
Dick's friend Ray Borden produced these laser-cut ribs for the project, but you can cut them with a band saw or a scroll saw.



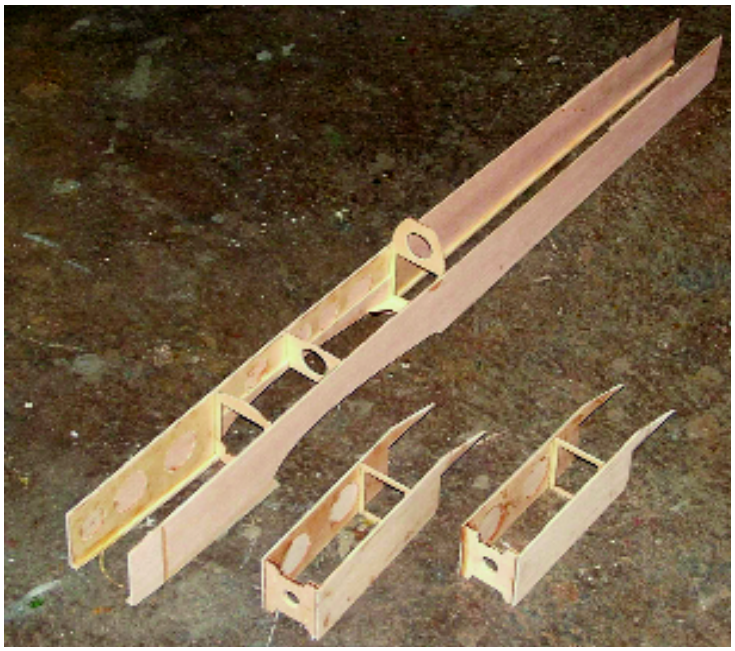
The wing panels can be built flat on a workbench. Put a piece of waxed paper over the plans and then assemble the parts. This ensures a warp-free wing!



The engine nacelle being fitted to the wing panel.

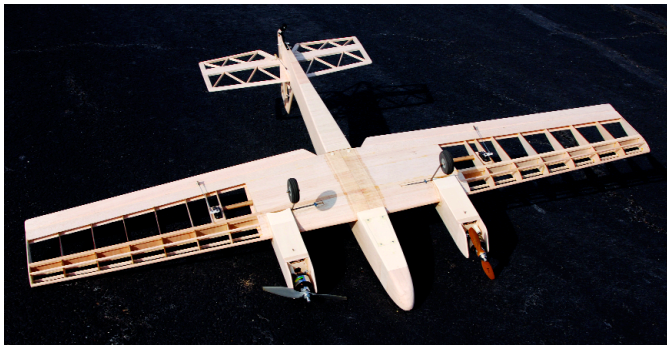


A bottom view of the completed airframe shows the nacelle with its bottom hatch in place.



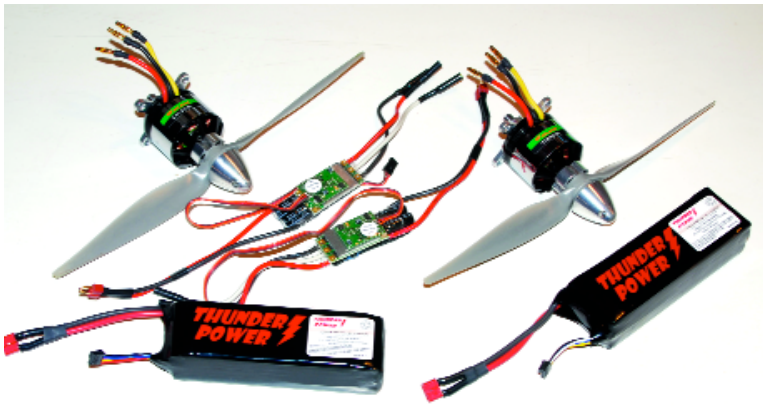
Left: The fuselage's and two nacelles' basic assembly reveals the simple structure of sheet-balsa sides, plywood doublers, and plywood bulkheads.

Above: The bottom nacelle hatch cover is removed. Notice the uncomplicated and effective latch system.

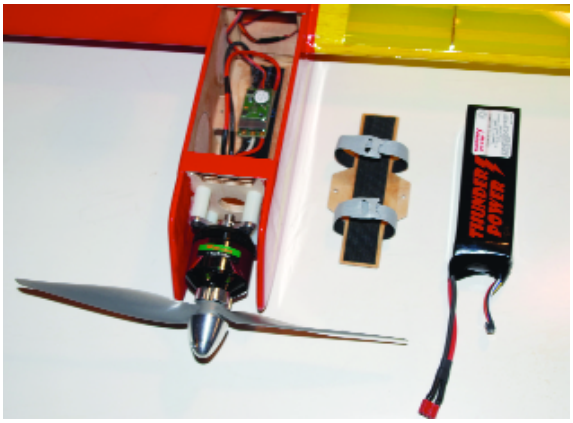


The bottom of the unfinished airframe reveals the exceptionally light structure. There is not too much sheeting!

A side view reveals the fuselage's straight lines. This makes construction straightforward but yields a pleasant profile.



The power system: two Welgard brushless outrunners; APC 12 x 8E propellers; Du-Bro aluminum spinner nuts; Castle Creations Phoenix-80 ESCs; Thunder Power five-cell, 3850 mAh Li-Poly packs.



Motors are mounted on 1-inch nylon standoffs. The ESC is held to the compartment floor with hook-and-loop fastener. Next to the airframe is the removable battery floor; it is screwed in place above the ESC.

Twin Engine Dos!

When I rounded up pictures of the twin-engine aircraft projects I've done through the years, I was surprised to count 17 designs of my own and two I built from kits. I like twin-engine airplanes.

Very few of my twins were true Scale projects. I've always liked aerobatic capability in models, so most of my twins have been stand-way-off scale or original aerobatic designs.

I have some tips for those of you who are going to tackle twin-engine projects.

• Use broken in, well adjusted, reliable engines.

• Electric power reduces much of the apprehension when it comes to twin-engine flying.

• Lightweight models with plenty of power are the way to safety if one engine dies.

If there's any question about a twin's single-engine flight capability, cut back the other engine and put down the nose for a landing if one power plant dies. Don't try to stretch the approach.

I go after several things in a twin's design. They are:

• A fairly light wing loading.

• Plenty of power for the airplane's size.

• Keeping the engines as close together as reasonably possible.

• The use of a large amount of fin and rudder area.

Most of my aerobatic twins are comfortable flying on one engine—either one. I've flown some on one power plant through loops, rolls, turns in either direction, and landing go-arounds, with no problems. Knowing that can be done reduces the worry about one engine dying.

Regardless of the risks, expense, and extra work involved in twin-engine projects, they're so neat and so much fun I'm sure they will always be a popular part of our hobby. It's the twin-engine sound! ***MA***

—Dick Sarpolus

Smooth, steady inverted flight is a cinch for this model. It tracks straight and true through all aerobatic maneuvers.

I laid out a wing planform with an 82-inch span and a wing area of 1,066 square inches. The wing is mildly tapered, with strip ailerons and a semisymmetrical airfoil.

I like Bruce Tharpe's designs, so I borrowed his Four-Star-type airfoil and wing construction. There is no LE planking or capstrips; this is simpler construction. And with the straight line on the bottom of the airfoil from the spar to the TE, the wing panels could easily be built flat on the workbench surface.

I made the fuselage 60 inches long with generous-sized tail surfaces. I located the nacelles on the wing to provide clearance for 12-inch propellers and room for larger propellers if desired.

I like a tricycle landing-gear setup on a model such as this, but a tail-dragger gear arrangement is more practical since I fly from several grass fields that can be fairly rough. The plans show both setups.

The basic airframe came out at approximately 4 pounds. With everything in it except the two battery packs, it weighed 7.5 pounds. Ready to fly, the prototype Lotsa Watts weighed roughly 9.75 pounds. I have to remind myself that it is equivalent to a glow-powered model with the fuel tanks filled—and that's not the way we normally give the weight of a glow-powered airplane.

My model's weight works out to a wing loading of approximately 21 ounces per square foot. That's a nice figure, again based on an airplane with "full fuel tanks."

I used a separate 1200 mAh Ni-Cd battery pack for the radio. Any ESC that is handling the high voltage of five Li-Poly cells will not typically provide a BEC radio output. I could have used a separate BEC to provide power for the radio, but I thought it was easy enough to just use a standard 4.8-volt radio battery.

I'd call this airplane a sport machine. It's certainly not aimed at RC Aerobatics competition or 3-D flying, but it will do anything aerobatic I can think of to try.

It has a great power-to-weight ratio and a light wing loading, and it will slow down for relaxed, easy flying. I use dual rates; low rate for my easy flying and high rate when I want to try wilder stuff.

This airframe is easy to build, so it shouldn't worry you if you want to try scratch-building. A band saw or scroll saw is needed since you do have to cut out all the wing ribs, fuselage bulkheads, etc. Sure, it's more work than building from a kit or an ARF, but I consider it a fun part of the hobby.

If this model looks interesting to you and you like to spend time in the workshop making some wood chips and sawdust, go for it!

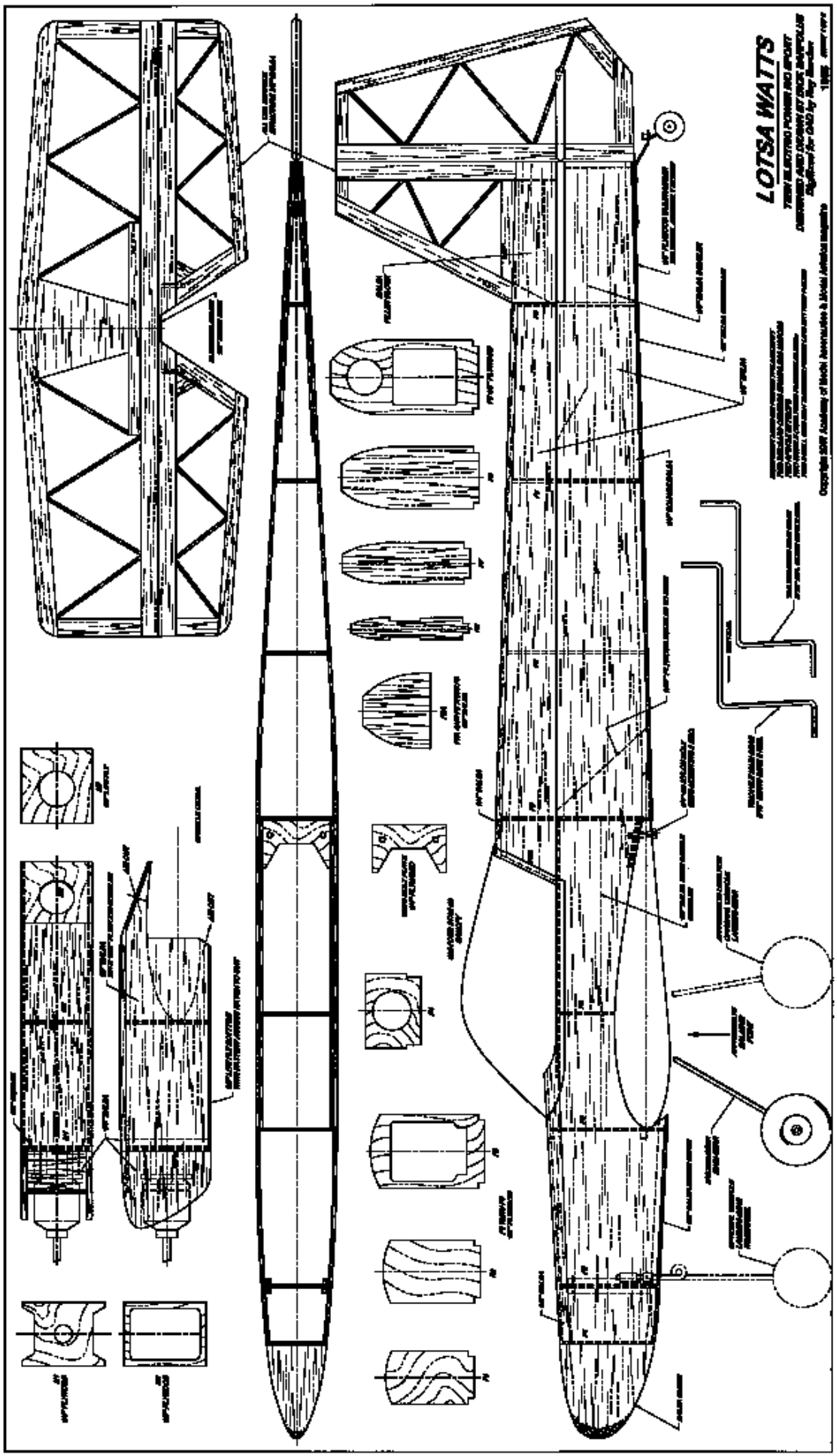
This is the first of my designs for which I didn't have to cut my own wing ribs. My friend Ray Borden, who did such a nice job with his CAD equipment digitizing my

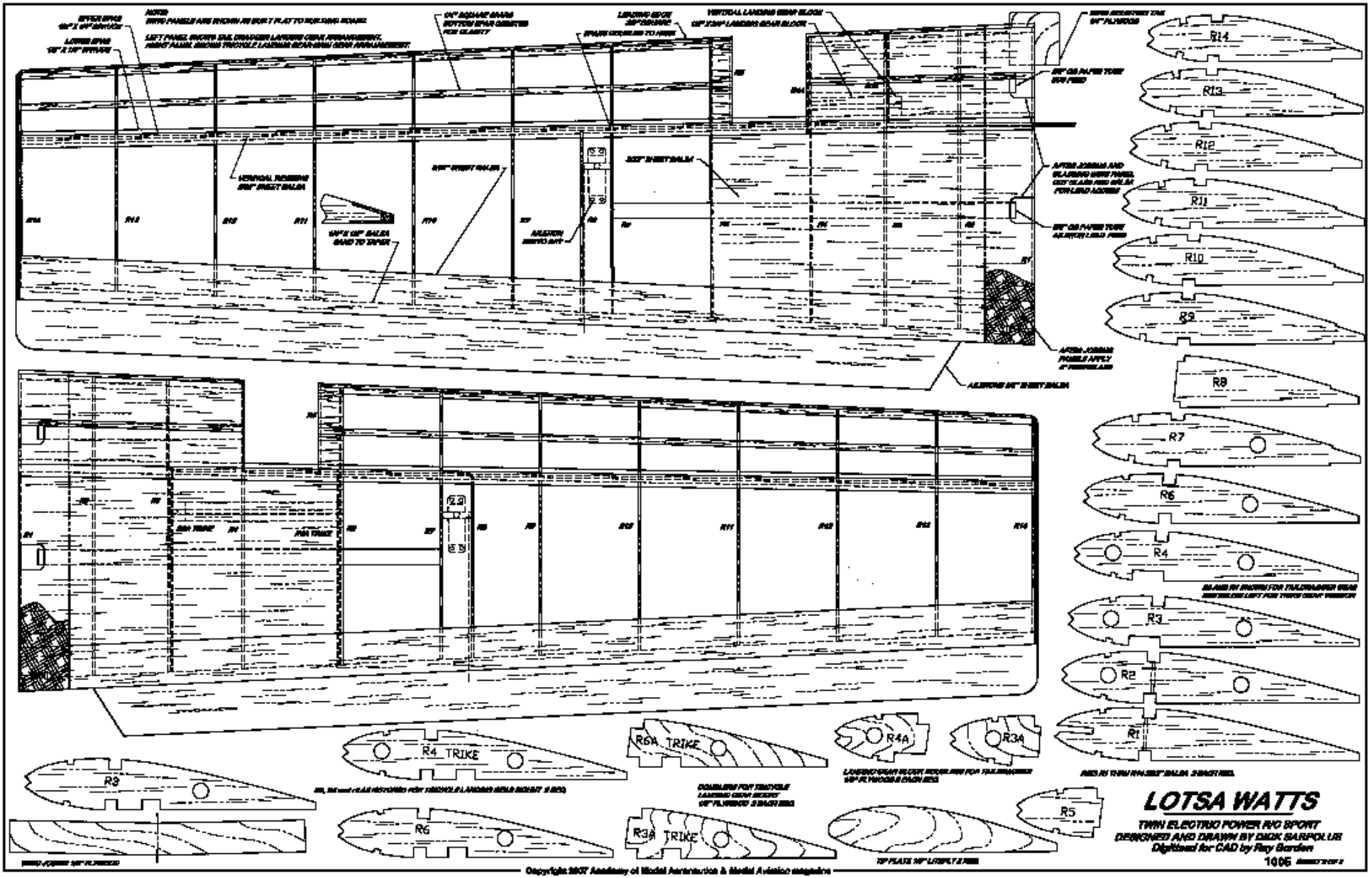
This airplane is majestic in flight. It has the performance of a Pattern-type design but is almost as docile as a trainer!

Lotsa Watts

Type: RC sport
Wingspan: 82 inches
Weight: 7.5 pounds without batteries
Flying weight: 9.75 pounds ready to fly
Wing area: 1,266 square inches
Length: 60 inches
Wing loading (ready to fly): 21 ounces/square foot
Motors: Welgard C50/55/06 brushless outrunner
Propellers: APC 12 x 8E
Power: Castle Creations Phoenix 50- to 80-amp ESC, two five-cell 3850 mAh Li-Poly batteries
Draw: 42 amps/motor
Output: 750 watts/motor
Watts/pound: 150
Radio: Four channels minimum with four standard servos
Construction: Built-up balsa and plywood
Covering/finish: MonoKote or similar film

Full-Size Plans Available—See Page 191





penciled plans, has a laser cutter. Since he had my plans in CAD, he did more work and laser-cut a set of ribs for me. With some work you can certainly saw-cut your own set of wing ribs, as I've done many times.

Ray also has a vinyl cutter, so he made the graphic airplane lettering for me. It's nice to have a friend like that.

I'll cover the specific equipment I used that worked so well for me. However, there are certainly many hardware choices on the market, which makes it nice for us modelers.

I used the Welgard C50/55/06 brushless outrunner motors from BP Hobbies. They look to be very well made, and after using one in a Nitro Models Bobcat I knew it had plenty of power. I also knew Howard at BP Hobbies would answer many of my dumb questions about electric power equipment; he has given me good advice before.

The only thing I don't like about Welgard motors is their huge propeller shaft. They are unusually large, and it's a pain reaming and/or drilling out propeller hubs for use on the motors.

Bob Zambelli, a modeling friend with machine-shop capability, turned down the prop-shaft adapters and gave them $^{5}/_{16}$-24 threads. I used Du-Bro aluminum spinner nuts in front of the propellers.

I mounted the motors with 8-32 bolts through 1-inch nylon spacers I found at The Home Depot and am using APC 12 x 8E propellers. I'm happy with the performance but will be trying other sizes for comparison.

For ESCs to control the motors I went with Castle Creations' Phoenix-80s. Their 80-amp capacity is overkill, as I figured each motor would draw less than 50 amps, but the 60-amp units were not in stock at the time, and these ESCs are so small and light that the weight difference was negligible. Also, I had the Castle Link USB Programming Kit so I could easily adjust any programmable settings on the ESC with my computer.

I planned on five-cell Li-Poly battery packs, and I knew that at the higher voltage the ESC would not provide a BEC output for the radio system. Rather than use a separate BEC I decided to employ a separate Ni-Cd pack for the radio system; weight wasn't an issue in this airplane.

For the Li-Poly batteries I went with five-cell, 3850 mAh Thunder Power packs. They are rated at 25C continuous discharge, 30C sustained discharge, 50C max short-burst discharge rates, and I knew I'd be operating them much more conservatively.

Thunder Power has been around for a while and has a good reputation, and I could count on these batteries. With the power available from the two motors I don't fly continuously at full throttle anyway, and the batteries would have plenty of capacity for my flying habits.

I like Deans Ultra connectors, and because they plug in so tightly I drill a $^{1}/_{16}$-inch-diameter hole in each connector and use a pair of snap ring pliers from Sears to help disconnect them. This works very well. I had a setup of Blue Bird servos on hand to use—item BMS-631MG from BP Hobbies with 69 ounce-inch of torque—and they have been working fine.

I've had good results with Berg receivers, so got one of the new 7P models. I don't profess to understand the True Digital Signal Processing and Transmitter Signal Recognition features, but they sound good to me. This is the smallest receiver I've used in something other than a park flyer-size airplane, but Castle Creations says it's full range and I believe it. It works fine!

CONSTRUCTION

I suggest that you make a kit of the parts before you begin construction. I don't have a wood list because I try to keep a good balsa and plywood supply on hand for building from scratch.

Lone Star Balsa is where I buy my wood. After making a rough estimate of the wood I think I'll need, I'll order more than that. It will be needed down the line for repairs or the next project.

I get a second copy of the plans or make copies of the part drawings on the

plans so I can cut the paper patterns to trace around with a ballpoint pen onto the balsa or plywood. It may be an old-fashioned method, but it works.

I cut everything out with a band saw or scroll saw. If the cutting is inaccurate, work with a sanding block will get the parts in shape. The accuracy is up to you.

Wing: I use waxed paper over the plans on a hopefully flat, smooth worktable. With this airplane's wing section, the bottom of the ribs from the lower spar to the TE is straight. So with the lower spar, lower TE sheeting, and center-section bottom sheeting positioned over the plans, you can locate, pin, and glue the ribs in place.

Oh, and you'll have to make your own tapered TE stock. I use a small, sharp block plane and a sanding block to get it to shape. Glue the TE and upper TE sheeting in place.

Before you can add the upper spar, you'll have to cut the vertical-grain spar webbing to fit. This webbing is a pain to add—each piece is different because the wing is tapered—but it adds a great deal of strength. I cut and block-sand each piece to fit.

Add the top spar, the LE, and the front spar. The top and bottom LE sheeting and the top center-section sheeting are added after the wing panels are removed from the building surface.

Plywood rib doublers are used to accept the grooved landing-gear blocks for the trike gear or the tail-dragger setup. Put the cardboard tubes in place through the ribs for the aileron-servo leads and the ESC leads before adding the upper sheeting. And you'll have to cut a vertical slot between the spars in the two inner ribs so the plywood dihedral joiner can be inserted.

Glue in place the plywood cap ribs on the wingtips. I wrapped the center joint with 4-inch-wide fiberglass cloth and epoxy, scraping off the excess epoxy for a smooth appearance. Glue a plywood mounting tab in place through the LE and center ribs to position the wing in the fuselage.

The ailerons are made from 3/8 balsa sheet. Their LEs are planed and block-sanded to the beveled shape, and their TEs are sanded round.

Tail Surfaces: The horizontal stabilizer, elevators, fin, and rudder are built over the plans from 3/8 balsa stock. Use whatever type of glue you prefer. I do much of the building with five-minute epoxy because it seems that I'm always in a hurry. Bevel to shape the elevator and rudder LEs, and sand the outer edges of the surfaces to be round.

The two elevators are joined by a bent piece of 1/8-inch-diameter music wire epoxied in place. On a model this size I prefer the pinned nylon hinges, and I use the Du-Bro tools to cut the slots for them. I fit all the hinges and epoxy them in place later, after the airplane is covered.

Fuselage and Nacelle: Start building the fuselage by gluing the plywood doublers to the balsa side pieces. I put lightening holes in the plywood doublers with a hole saw in a small drill press. The wing-saddle pieces, stabilizer saddle doubler, and lower edge strips also need to be glued to the fuselage sides before assembly.

Glue bulkheads F3, F4, and F5 to one fuselage side and then add the other side. For easy alignment the fuselage sides are parallel above the wing. The nose and tail sections can be pulled in, and the remaining bulkheads can be added.

The upper rear side pieces are cut oversize, and their lower edges are beveled to mate with the main fuselage sides. When they are glued in place, I block-sand their upper edges flat in line with the bulkhead tops and then I add the 1/4 balsa top piece and sand it smooth and round.

The forward-fuselage top sheet is curved over the bulkhead tops and glued in place. The fuselage bottom sheeting is added later, after the tail-surface linkages are in place.

I made a removable hatch in the forward-fuselage bottom section for access

to the radio battery pack and nose-gear steering (if tricycle gear is used). If a large balsa block is unavailable, you can make the nose block by laminating thinner material together.

The nacelles are built like the fuselage. Start by gluing the plywood doublers to the balsa sides. Join the sides with the plywood motor-mounting bulkhead and the rear bulkhead. Add the balsa top pieces and round them off.

It's easier to drill the motor-mounting holes in the plywood bulkhead before assembly. Epoxy in place the balsa motor-cowling side pieces and round their edges. The nacelles fit in place on the wing panels, between the two plywood partial ribs, and are epoxied in place.

The nacelle motor-mount bulkheads have spaces top and bottom to admit cooling air to pass over the ESCs and Li-Poly batteries. The cooling air can exit through holes in the rear upper nacelle sheeting and the opening in the lower rear of the nacelle.

I have removable plywood hatches on the bottom of the nacelles for access to the ESCs and the Li-Poly battery packs. The hatches have spring-loaded, quick-release latches for convenience.

The ESCs are mounted to the floor of the compartment with hook-and-loop fastener and have removable plywood plates screwed in place to accept the Li-Poly battery packs, which are also held in place with hook-and-loop fastener. There's plenty of room for cooling air to flow through.

I mounted the motors with 1-inch nylon standoffs; I felt that would leave room for any other type of motor setup I might want to try. The motors are pretty much in the open for easy access and good cooling.

The landing gear is bent from $^3/_{16}$-inch-diameter music wire, and I use a heavy-duty K&S bender to do the job. You'll have to decide while building the airframe if you want a trike-gear setup or the tail-dragger setup I used.

I went with 3-inch light foam wheels to handle grass fields. I like the leaf-spring-type tail-wheel assemblies, with the steering arm connected to the rudder by small coil springs.

Final Assembly: Fit the fuselage to the wing, align it, and bolt it in place. The bulkhead at the wing LE can be sanded or shimmed for a good fit of the wing-mounting tab, and the fuselage wing-saddle opening can be sanded for a good fit to the wing. With the wing held in place, I drill through the wing into the fuselage mounting plate for the tapped holes to accept the nylon wing-mounting bolts.

The horizontal stabilizer is added and glued into the fuselage once its alignment with the wing is confirmed. The last step is to add the vertical fin. With all control surfaces hinged and in place, add the control horns and linkages from the servos.

I like fiberglass-tube pushrods or the flexible nylon-tube linkages. Plywood aileron servo mounts are glued in place between the closely spaced ribs in the wing panels.

I used a plastic canopy from Sig Manufacturing—the one from its Four-Star 60. I covered my model with MonoKote. I'm used to working with it and doing the heating and tugging necessary for a decent job.

For final balancing of the airplane I positioned the Li-Poly battery packs toward the rear of the space in the nacelles and positioned the radio battery just ahead of the wing. I have the balance point almost on the bottom wing-spar location, at the fuselage side. As I get more flight time on the airplane I may move the balance point for finer tuning, to get the response that makes me comfortable.

Then I set the control-surface throws. The rudder has as much throw as it can get without interfering with the elevators. The elevators, measured at the TE, have approximately 2 inches of throw; low rate is set at 50%. The ailerons have roughly 1

inch of throw, and low rate is set at 50%.

Control-surface travel, dual rate settings, exponential, and airplane response should be set to suit the pilot. I have friends who are comfortable with control settings on their airplanes that are so sensitive I couldn't live with them. It's an extremely personal thing.

I'm happy with Lotsa Watts. It was easy to build, it's big but not too big, it's capable of any kind of flying I want to do, and it is simple to fly.

The plus is those twin motors. There is the excitement of a twin, with electrics and without the worry of one motor stopping at a bad time. Good stuff! MA

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Sources:

Welgard motors:
BP Hobbies
140 Ethel Rd. W. Suite J
Piscataway NJ 08854
(732) 287-3933
www.bphobbies.com

Phoenix ESC, Berg 7P receiver:
Castle Creations
235 S. Kansas Ave.
Olathe KS 66061
(913) 390-6939
www.castlecreations.com

Li-Poly batteries:
Thunder Power
4720 W. University Ave.
Las Vegas NV 89103
(702) 228-8883
www.thunderpower-batteries.com

Ultra connectors:
W.S. Deans Co.
10875 Portal Dr.
Los Alamitos CA 90720
(714) 828-6494
www.wsdeans.com

Balsa, building materials:
Lone Star Balsa
115 Industrial
Lancaster TX 75134
(972) 218-9663
www.lonestar-models.com

Hardware, accessories:
Du-Bro
Box 815
Wauconda IL 60084
(800) 848-9411
http://dubro.com

Music wire, tools:
K&S Engineering:
6917 W. 59th St.
Chicago IL 60638
(773) 586-8503
www.ksmetals.com

Clear canopy:
Sig Manufacturing
Box 520
Montezuma IA 50171
(641) 623-5154
www.sigmfg.com

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Great Planes Model Distributors
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Champaign IL 61826
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www.monokote.com