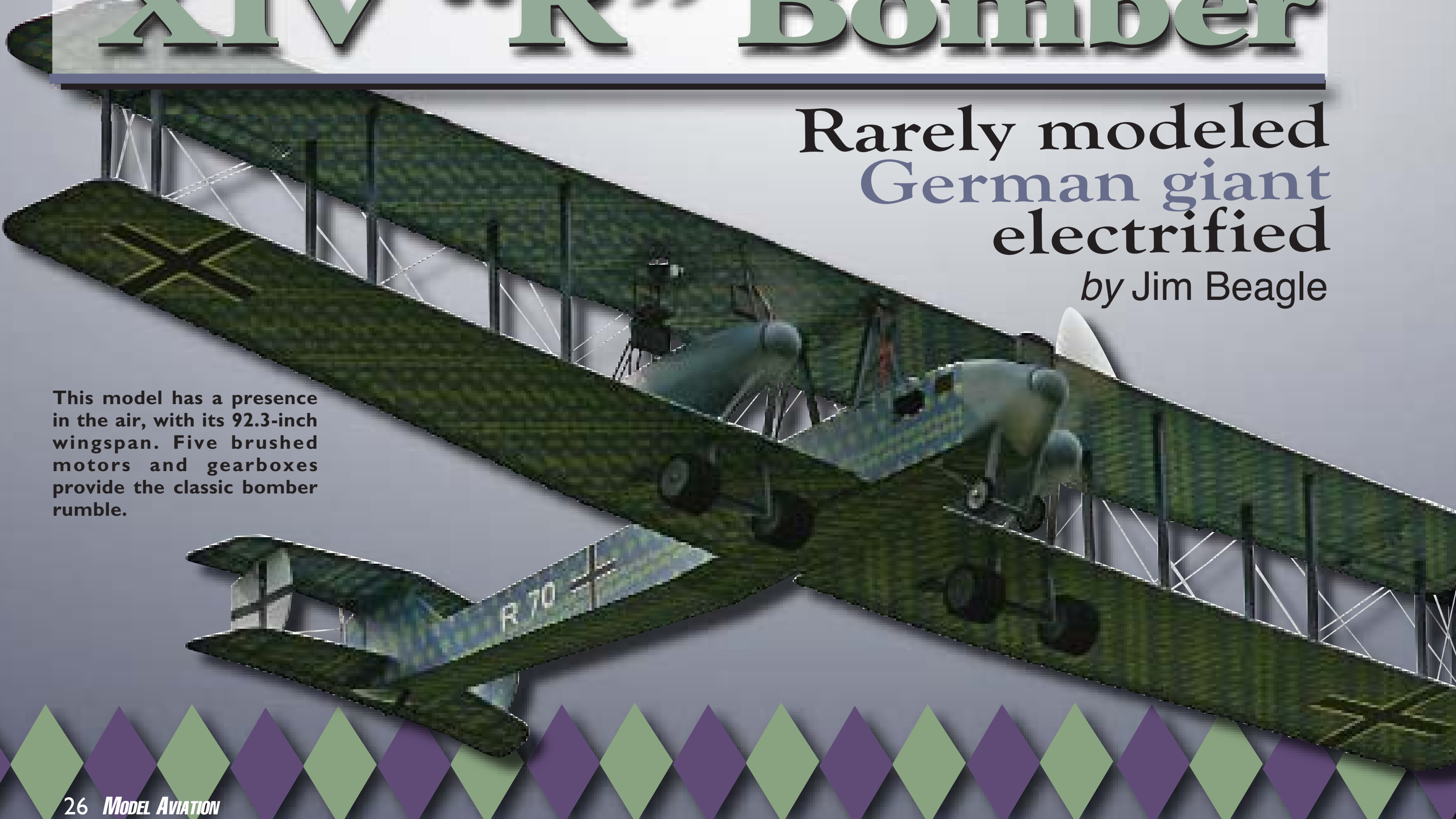
The ground crew poses for a photograph. This scene is similar to that in an original picture that the author found.

Zeppelin-Staaken XIV "R" Bomber

Rarely modeled German giant electrified

by Jim Beagle



This model has a presence in the air, with its 92.3-inch wingspan. Five brushed motors and gearboxes provide the classic bomber rumble.

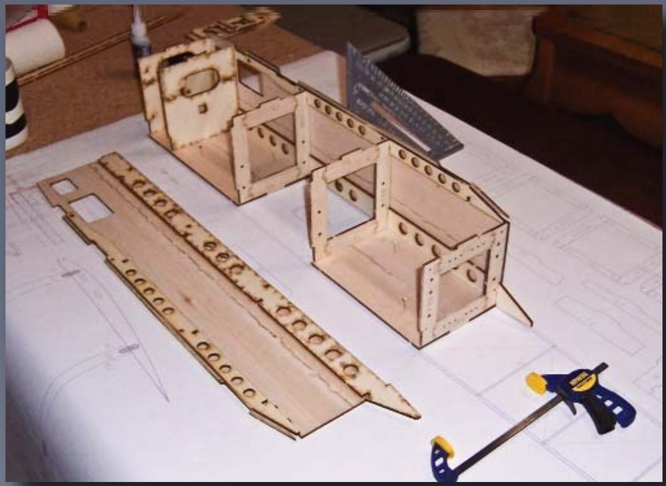
Photos by the author

"R-PLANES" WERE THE German giants of the Great War. The "R" stood for Riesenflugzeug, which translates to "giant aeroplane." These strategic bombers were a result of Ferdinand Graf von Zeppelin's ambitions and imagination.

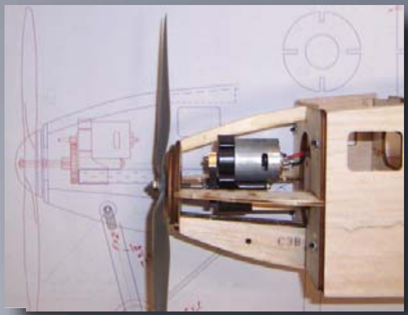
He had realized how vulnerable his large dirigible airships would be as soon as airplanes could get to them. Zeppelin took advantage of the great space available in the airship sheds and built most of these bombers at the Berlin suburb of Staaken.

Zeppelin-Staaken engines were housed in nacelles that were big enough for the mechanics to make in-flight repairs by literally working within each gondola. The massive 18-wheel undercarriage had to bear enormous weights, with huge 1,000-kilogram bombs. A ground staff of 42 was required just to get the aircraft out of the hangar.

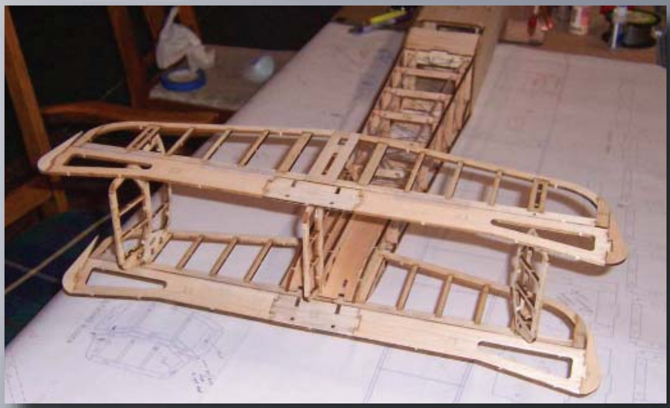
The Staaken was difficult to shoot down, with its size, defensive guns, and security of its five engines in tandem push-



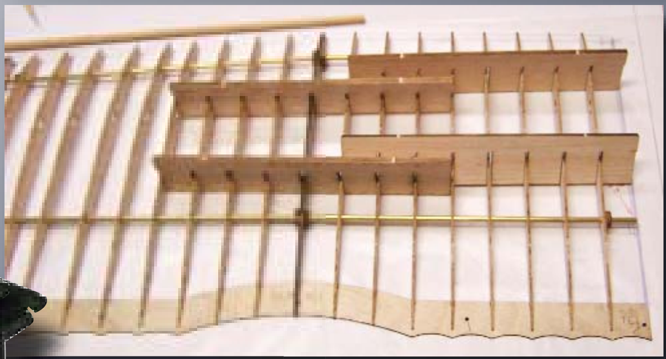
Box construction is used for the front of the fuselage, with sides, formers, and doublers keyed together.



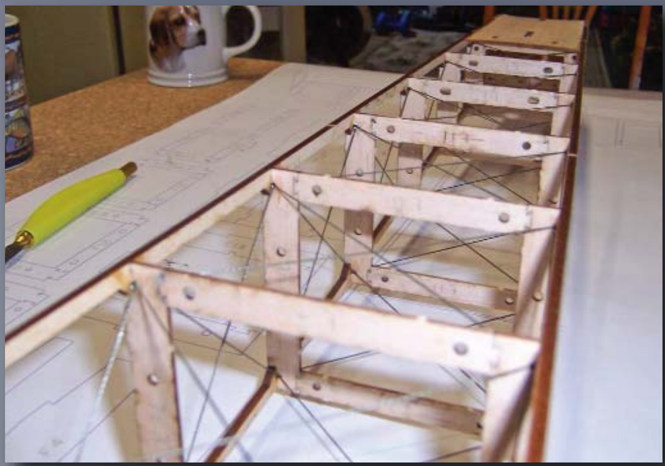
Right: Five brushed GWS Speed 400s geared 3.0:1 provide the power. The nose motor is shown, installed within the cowl framework.



Below: Upper and lower horizontal stabilizers and elevators are identical. Pull-pull tubes are installed through the formers.

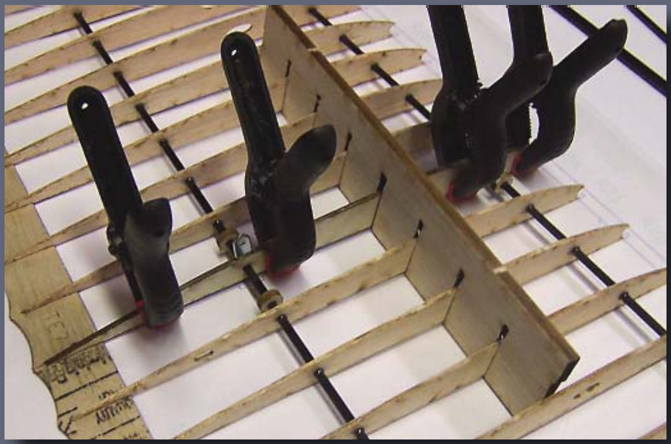


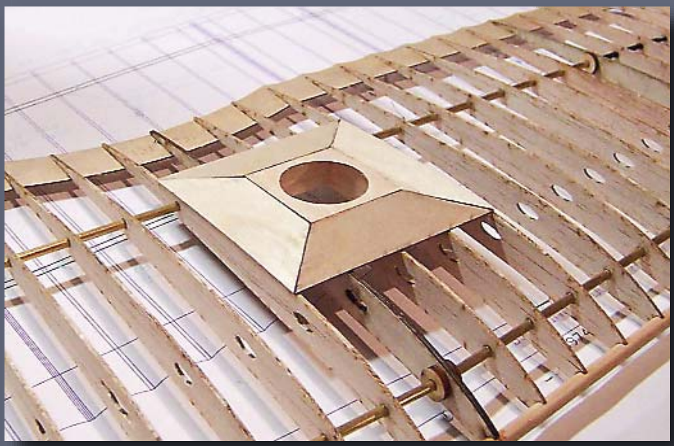
Laser-cut "combs" aid in aligning ribs over the plans.



Jim designed the tail of the fuselage to incorporate a cross-stitch pattern of braided line. Braided line is passed through small laser-cut holes in the corners of each former.

Laminated interplane struts are attached to laminated ribs using Du-Bro straps. These provide a secure and easy method of attachment.

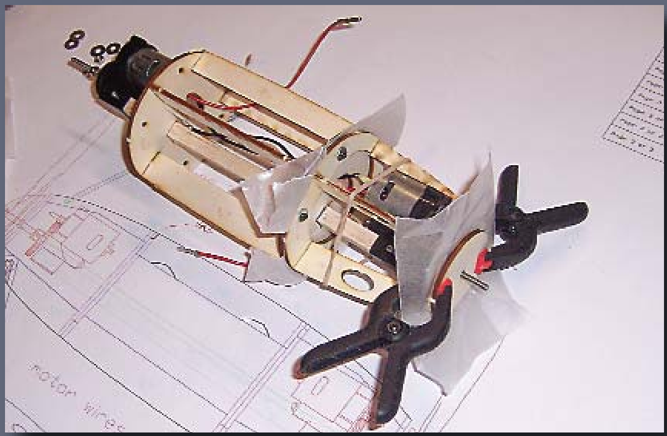




Three $^1/_{32}$ plywood ribs are laminated together to capture the Du-Bro straps. Spars are $^1/_8$-inch-diameter carbon-fiber rods.

The top wing has two turrets built from $^1/_8$ balsa and covered with $^1/_{32}$ plywood.

Blue foam has been sanded to shape to form the engine nacelle. It is supported with light plywood and carbon-fiber rods.



Each nacelle supports two motors: one as a tractor and one as a pusher. The motors are mounted on a 10mm balsa stick.

This shows the externally mounted radiators; each of the five motors has one. The mechanic is standing in the access opening that made in-flight repairs possible on the full-scale aircraft.

The Staaken had an interesting defense method. Above each nacelle, a hole through the upper wing allowed crew members to climb up a small ladder and fire their guns at the enemy approaching from above.

This five-color lozenge pattern is a modified version of one that Jim found on the Internet. He printed it on tissue and then applied it over Solite.

It takes a lot of wood to construct the Staaken; 47 sheets were required. Manzano Laser Works handled all of the laser cutting.

Above: The Staaken stands ready for its first mission. The lozenge pattern helps it blend in with its surroundings on the ground or in the air.

Right: The five motors put out approximately 64 watts per pound. The amount of drag on this large bomber requires that it be at full power throughout the flight.

Watch the Zeppelin-Staaken XIV Flight Video!

Keith Shaw piloted this design's second flight, which took place at the Mid-Am Electric Flies event in Northville Township, Michigan. Go to the *Model Aviation* Online Web site to see footage showing how this behemoth handled the less-than-ideal weather conditions. MA

—*Jay Smith*

Sources:

Model Aviation Online
(765) 287-1256
www.modelaircraft.org/mag

pull arrangements. Only two R-planes were lost during raids, and that was because of a failed landing in fog and a mechanical failure.

The Ukrainian government chartered one of the last of these biplanes that Zeppelin-Staaken built, R70/18, to transfer funds into the country from Germany. R70 was confiscated by the Romanians on September 19, 1919, following a forced landing at Bessarabia, in Eastern Europe.

I had wanted to build a large bomber for sometime, and I was convinced that a large World War I biplane was in my future when I saw the movie *Flyboys*. This would be my first attempt at designing a model.

With the large quantity of ribs, this project was perfect for laser cutting. I used three-view drawings from Windsock Datafile #123, *Staaken at War*, as a basis for the scale outline, with specific details drawn using AutoCAD 2000. The final drawing includes all necessary views for building and a layout of all 47 laser-cut sheets.

Charlie Bice of Manzano Laser Works provided expert advice, regarding wood selection and laser kerf allowances, and other design assistance. This company was excellent, providing quick response and delivery times. Hardly any stock balsa is used in this design; nearly everything is laser-cut to fit.

CONSTRUCTION

Fuselage: After many hours of AutoCAD work, I was eager to get the CA flowing; I started with the outboard rudders. The 1/8 balsa parts were assembled over the plans, and I protected them with waxed paper.

Thin CA was applied to the joints with a microtip applicator.

The upper and lower horizontal stabilizers and elevators are identical and contain 1/8 balsa parts. For extra strength in key areas, I used laminated 1/32 plywood between two corresponding 1/16 balsa parts and then sanded to a common thickness with the mating balsa details.

The front of the fuselage is a typical box construction. But it is more than 4 inches wide, so each side consists of two laser-cut 1/8 balsa parts adhered at the saw-tooth joint. Then the 1/8 light plywood fuselage doublers are aligned and glued to the upper and lower edge of the fuselage sides.

I made the fuselage formers from 1/8 light plywood and balsa. Dovetail joints are used to assemble the four sides of each former, with the wood grain running in the direction that will maximize strength.

The bottom sheet is pinned to the building board, and then the fuselage sides are assembled. You can also construct the rudder servo tray inside the fuselage at this time. The rudder and elevator are pull-pull, and the servo trays are designed for standard units in the proper orientation.

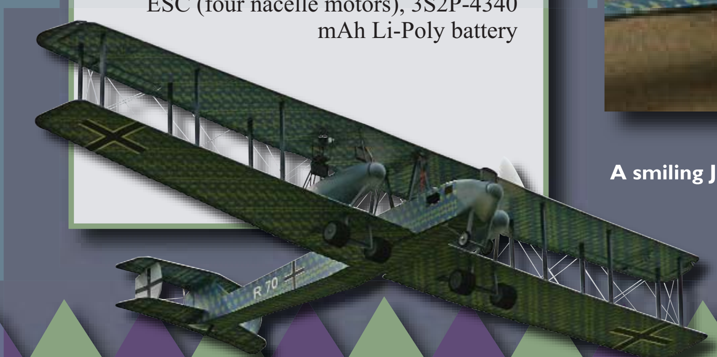
The front elevator servo is installed on its side and supported by using parts V2 and both V3s. This method aligns the servo arm with the elevator motion, providing a simple pull-pull line attachment.

Staaken pilots had access to the top side of the fuselage in two places forward of the wings. The area between those openings was a natural place for a battery hatch.

I attached the front cowl to the firewall with 4-40 blind nuts and socket-head capscrews. Two 1/8 balsa fuselage doublers are installed near the upper edge and two scrap pieces are glued to the fuselage floor, to give the landing gear straps something to screw into.

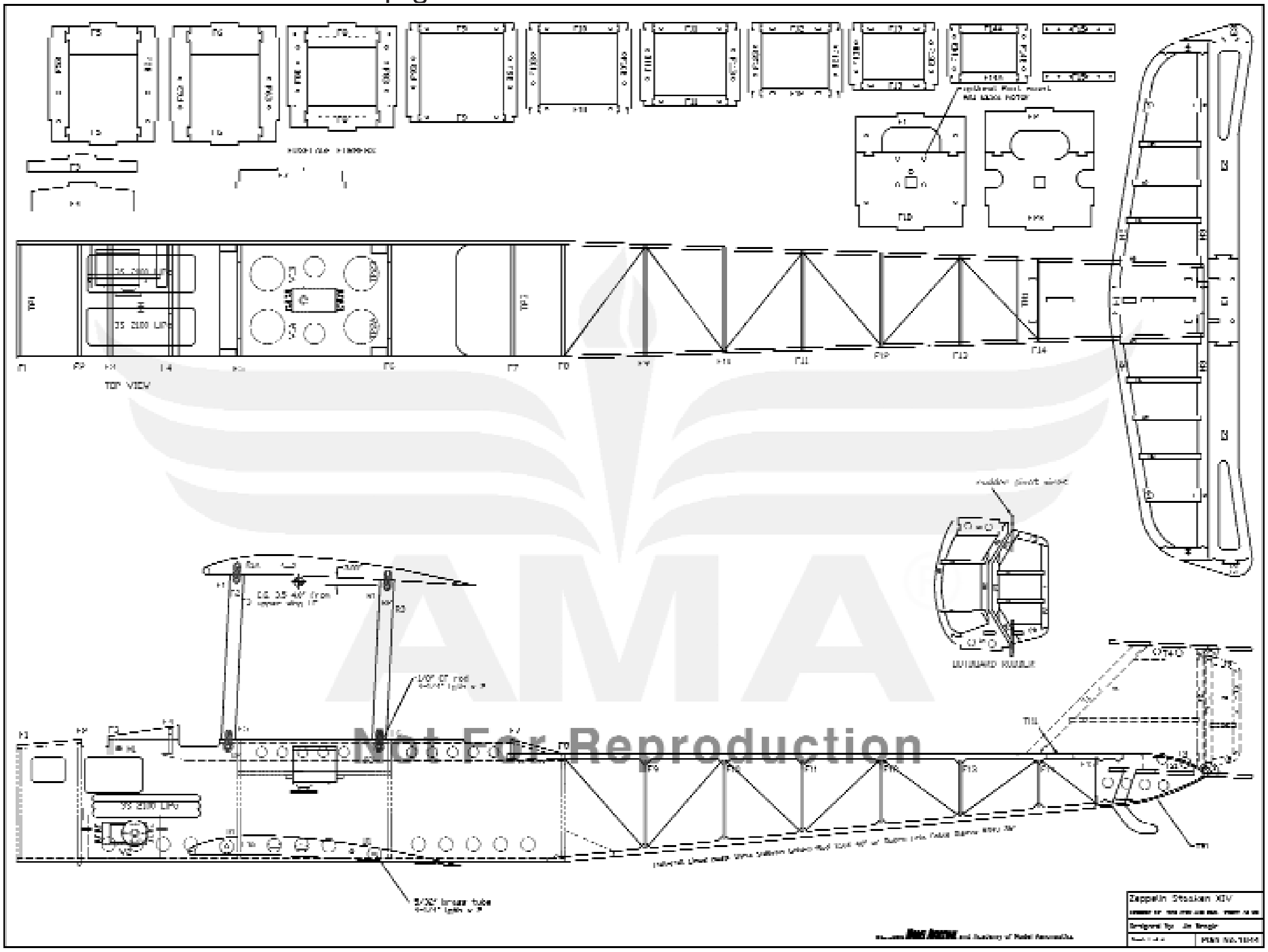
Zeppelin-Staaken XIV "R" Bomber

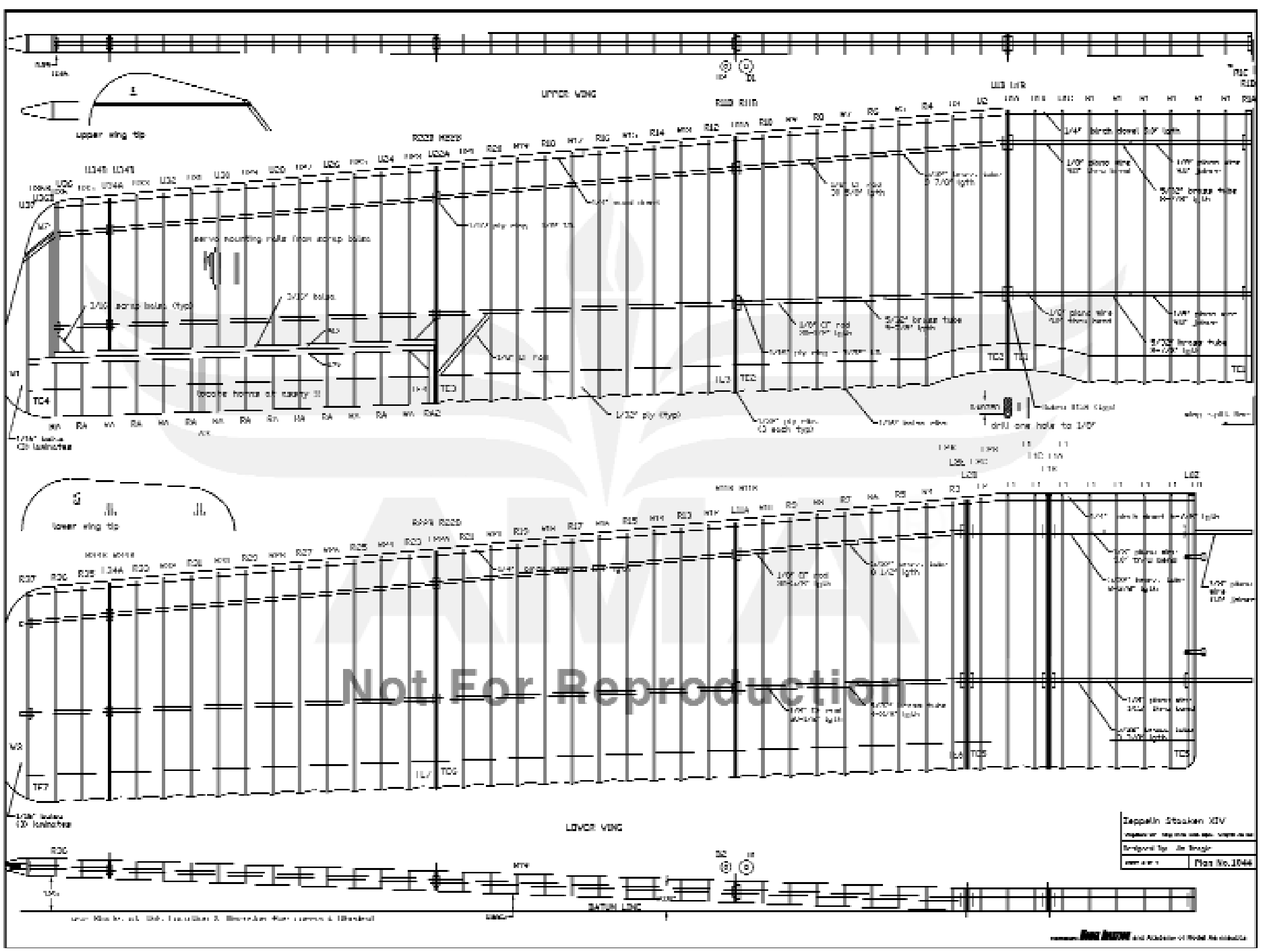
Type: RC semiscale
Skill level: Intermediate builder, intermediate pilot
Scale: 1:18
Wingspan: 92.3 inches
Wing area: 1,724 square inches
Weight: 7.5 pounds
Wing loading: 20 ounces/square foot
Motors: Five Speed 400 with 3.0:1 gear
Propellers: APC 9 x 4.7
Watts: 480
Power: 64 watts per pound
Radio: Spektrum AR6200 receiver, Hitec HS-81 aileron servo, Hitec HS-425 rudder and elevator servos
Other: Castle Creations Griffin-55 ESC (front motor and receiver), JOMAR analog ESC (four nacelle motors), 3S2P-4340 mAh Li-Poly battery

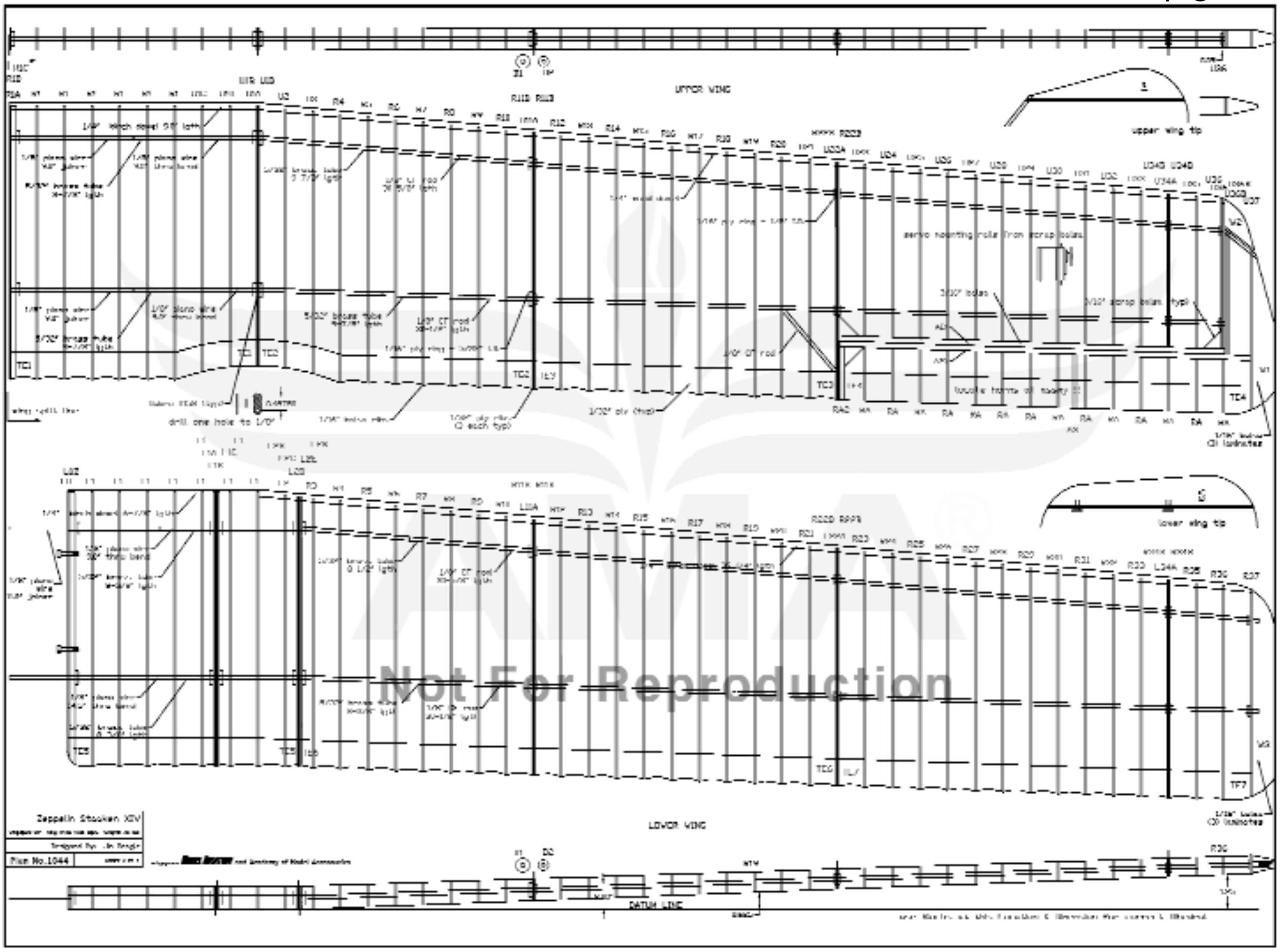


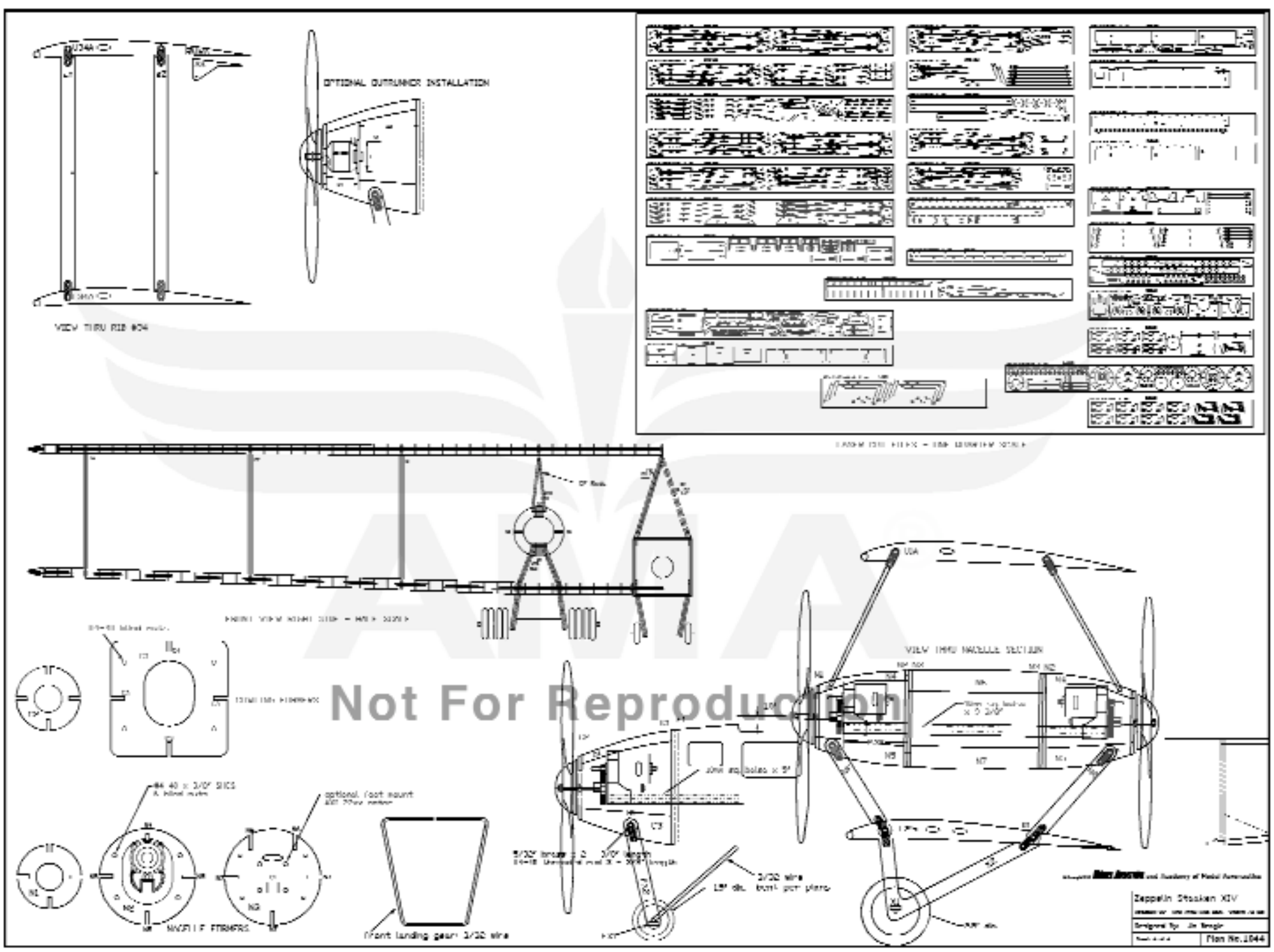
A smiling Jim Beagle with his completed aircraft and its crew.

Full-Size Plans Available—see page 167






UPPER WING
upper wing tip
lower wing tip
LOWER WING
Zeppelin Staaken XIV
Plan No.1044
DATUM LINE
Not For Reproduction


OPTIONAL OUTRUNNER INSTALLATION
VIEW THRU RIB #34
VIEW THRU NACELLE SECTION
NACELLE FORMERS
front landing gear: 3/32 wire
Zeppelin Staaken XIV
Plan No.1044
Not For Reproduction

I wanted the Staaken to be powered by five brushed motors and gearboxes, for that classic bomber rumble. The GWS gearboxes are designed for 10mm square hard balsa sticks, which BP Hobbies sells in 12-inch lengths.

The position of the gearbox was adjusted to provide clearance between the cowl and the 1/8 light plywood spinner backplate. The diameter of the 400 motor interferes slightly with the top stringer of the cowl frame, which must be sanded to fit.

After I verified the clearances, I epoxied the motorstick in place. The model's cowl was created using four blue-foam blocks, adhered in place into the cowl frame with aliphatic glue.

I employed a belt sander, then a coarse-grit sandpaper block, then a 220-grit sanding bar to achieve the desired shape. The interior was opened up with a drum sander on an electric rotary tool.

The Staaken XIV employed two undercarriage legs with fairings to support the front axle. The front legs are two light plywood struts laminated together. The front axle is also supported from the rear with a 3/32-inch-diameter wire, bent to shape over the plans.

I sanded a groove into the underside of the foam cowl in the area around the landing gear attachment rod. The strut attachment is a 5/32-inch-diameter brass rod inserted through the cowl's laminated stringers and epoxied in place.

A 4-40 threaded rod then passes through the brass bushing. The front landing gear assembly was temporarily clamped in position, to verify locations. I added two scrap pieces of light plywood and glued them between the fairings, for a bit more strength.

The area around the landing gear is filled with spackle and sanded smooth. The 3/32 wire axle, rear landing gear wire, and axle plate are lashed together using braided musky fishing line.

I fabricated the tail end of the fuselage from four 1/8 basswood laser-cut stringers. The basswood stringers are glued to the rear fuselage side and then glued to the front fuselage box. The formers are each assembled into notches in the basswood stringers.

The tail assembly is built over the plans. I soaked the 1/16 balsa parts with water, bent them into a curve, and let them dry for a few hours.

The tail of the fuselage was designed to incorporate a cross-stitch pattern of braided line. Starting on the bottom side of the box end of the fuselage, I passed the braided line through small laser-cut holes in the corners of each former.

I stretched each string segment taut and wicked thin CA into the hole to hold the string in place. I applied a drop of thick CA after the second string was passed through each hole, and then I sprayed kicker while holding the braided line tight.

The crisscross pattern of braided line greatly improved the rigidity of the fuselage while maintaining the lightweight structure. Plastic tubes are threaded through the laser-cut holes in each former for pull-pull lines to pass through.

Wings: A unique attachment method is used on the wing struts. Metal landing gear straps (Du-Bro item 158) are laminated between two 1/32 plywood ribs. A third plywood rib in the middle is used to align and keep the strap in place.

One end of the Du-Bro strap is drilled out to 1/8 inch in diameter, for a carbon-fiber spar to pass through. Then the interplane struts can be attached to the straps with #2-56 blind nuts and socket-head capscrews.

Starting with one side of the upper wing, I constructed the spars from 1/8-inch-diameter carbon-fiber rods cut to length. The rods slide into 5/32 brass tubing, per the plans. Two short sections of wire are bent over the plans to join the two sections of brass.

The TE is pinned to the board over the plans. The balsa ribs are "skewered" onto the rear spar, like a shish kebab.

Four laser-cut rib-alignment combs are utilized to help keep things straight during assembly. I used thin CA to glue the ribs to the TE and then adhered the ribs to the rear spar with a drop of thick CA.

The laminated ribs are not glued until the upper wing has been removed from the board. The front carbon-fiber rod spar is inserted through the ribs, and the process is completed from root to tip.

The 1/4 balsa dowel LE is glued to each rib. After all 1/16 balsa ribs are glued, I flipped the wing over and aligned the Du-Bro straps between each of the three 1/32 plywood ribs, clamped them together, and wicked CA into the edges. Then I glued the "doughnuts" onto each side of the laminated ribs, for lateral strength.

Aileron ribs are keyed into the hinge line. The aileron tip is three pieces of 1/16 balsa, laminated and sanded into a classic wingtip profile. The ribs are not thick enough to fully install the Hitec HS-81 servo and enclose it with a hatch, but the servos are unobtrusive with the wing undercamber.

The Du-Bro straps point up on the bottom wing, so the three plywood ribs can be assembled directly on the board. The ribs are assembled using the same methods as on the upper wing.

Although the lower wing does not have ailerons, it does have other design and building challenges. In addition to the swept-back portion, it has 2° of dihedral.

The outer section of the wing is supported on blocks at the appropriate angle, and the joiner wires are bent per the plans. Strut ribs in this section support the landing gear below and the nacelle above, so there are five ribs laminated together to set the correct angle for the Du-Bro straps.

The Staaken had an interesting method of defense. Above each nacelle was a hole through the upper wing; the crew members could climb up a small ladder and fire their guns at the enemy approaching from above. I wouldn't think that would have been the safest position with a Bristol Fighter coming down on you!

The turret box is framed with scrap balsa; the box protrudes above the ribs by 1/8 inch all around. The turret fairings and cap are built from custom-fit 1/32 plywood.

The 36-inch servo extensions are threaded through the rib holes in the upper wings, and 12-gauge motor wires are installed in the lower wings. Scrap balsa is added to the area where the wires will come out of the wing covering.

I built the nacelle struts using four balsa lengths that create a hollow center, through which the motor wires pass. The center of each interplane strut is 1/32 plywood and captures the end of the Du-Bro strap. The center-section is sandwiched between two pieces of 1/8 light plywood, glued, and clamped together.

Nacelles: These are similar in construction to the cowl, with 1/8 light plywood forming the skeleton of the structure. I cut the 10mm x 10mm balsa stick to length and installed it in the center nacelle section but did not glue it, allowing the GWS 400 motor gearbox to be temporarily mounted.

I glued four 4-40 blind nuts into the firewall and then attached the cowling baseplate with 4-40 1/2-inch bolts. I dry-assembled the cowl front plate with stringers. Then I centered the spinner backplate onto the prop shaft and clamped it into position.

After checking that all parts are seated, centered, and square, glue the assembly together. You can flesh out the nacelles by adhering four sections of blue foam in place and then sanding to shape.

I glued a paper copy of the cross-sectional view of the nacelles onto a piece of fan-fold foam to use as a fixture spacer between the lower wing and the nacelle, to ensure the proper incidence. The lower strut attachment points have a similar construction as the front cowling, using the Du-Bro straps with 4-40 threaded rod.

Final Fit and Assembly: The center rudder is of conventional design with CA hinges, but the outboard rudders are "balanced." I inserted two short lengths of music wire into each end of the rudder. These plug into short lengths of brass tubing that are epoxied into the upper and lower horizontal stabilizers, thereby allowing the rudders to pivot.

The center wing struts attach to four points on top of the fuselage. Du-Bro metal landing gear straps are bent at a 30° angle toward the center.

The carbon-fiber rod and straps are assembled in place. Lower wing spars plug into the brass tubes that span the fuselage. Fuselage struts meet at the center of the top wing and capture a Du-Bro strap on each spar.

The carbon-fiber rods and doughnuts are aligned and glued into the fuselage. Nacelles are again assembled to the lower wing.

Nacelle struts going to the top wing are made from 3/32-inch-diameter wire slid into lengths of 4mm carbon-fiber tube. A short length of brass tube is pinched at the top of the struts, and 2-56 bolts are attached through the Du-Bro strap.

Finishing: I fiberglassed the nacelles with 3/4-ounce cloth and water-based polyurethane mixed with baby powder to fill the weave.

Two more coats were needed to get a smooth surface.

I added several panel lines using 1/16-inch pin-striping. Struts and nacelles were painted with Model Master Intermediate Blue. The interplane struts were painted with Blue Angel Blue.

Unable to find propeller spinners that were the appropriate shape, I happened upon some plastic Easter eggs in the grocery store that would work. Each egg had a small package of chocolates inside, so I had to buy a few extra. Yum!

The backplate is 1/8 light plywood laser-cut to 2 inches in diameter. Four 1/4 x 3/8-inch balsa blocks are glued and sanded to fit the interior egg profile. Then I used a rotary tool to cut the eggs to the correct size.

My propeller shafts are threaded, so I used four small button-head screws to attach the spinner after mounting the propellers.

Covering: Some Zeppelin-Staaken bombers had lozenge covering with large polygons of irregular patterns that were hand-painted on the airframe. The R70/18 model used the conventional five-color, top-side lozenge fabric that was preprinted and used on other biplanes of the era.

However, at a scale of 1:18, the lozenge fabric would be only 3 inches wide. To put this into perspective, there are roughly 75 polygons in a 3 x 3-inch area; that extrapolates to more than 36,000 polygons on my design's airframe!

The printed-tissue-over-Solite technique was the only practical method to use to achieve this excessive amount of lozenge pattern at this scale. Solite is made in England and weighs only .6 ounce per square yard. I covered each part of the airframe with this base layer of white covering.

I found the five-color lozenge file on the Internet in a PDF file and used publisher software to customize the patterns. Standard tissue at my hobby shop is 20 x 30 inches, so I taped two sheets of copy paper to an 11 x 30-inch overall size.

I sprayed a coat of Krylon Easy-Tack onto the carrier paper and then laid the tissue on the paper to smooth all of the wrinkles. I use an HP-9650 printer, which allows for direct-through printing of 11-inch-wide paper. The printer settings are at normal. I find that the best ink setting applies too much ink and causes more wrinkles.

A thin coat of nitrate dope is applied to the Solite-covered surfaces and allowed to dry. Then the printed tissue is positioned in place. There is still some Easy-Tack on the back side of the tissue, so it is simple to reposition until you achieve the correct location.

I brushed thinner onto the lozenge, which soaked through the tissue and combined with the nitrate dope for permanent adhesion. I also applied two more coatings of 50/50 dope and thinner for a bit more shrinking. Last, I sprayed on a water-proofer for additional protection against the elements.

Ailerons are attached with a simple tape hinge onto the Solite. Various pieces of lozenge tissue are laid out to create the patterns for the ailerons. The hinge line is simulated with a thin black line over a wider gray line, to give the illusion of depth to the hinge.

I created the Balkenkreuze (a stylized version of the Iron Cross) with my publication software and then printed it simultaneously with the lozenge pattern onto the tissue.

Flying: The morning of the maiden flight brought only a slight breeze from the northeast. The ailerons were programmed with one-third less down differential. The three rudders had approximately 30° throw and the two elevators had close to 20°.

The 16 wheels for the main landing gear are only 2 1/2 inches in diameter, so the rollout on rough grass was difficult. I placed the Staaken on the smoothest part of the field and made final checks.

I entrusted Keith Shaw with the sticks for this maiden flight. The sound of five propellers, five gearboxes, and five brushed motors under full throttle was awesome.

Rollout continued for roughly 70 feet, when the model's wheels finally parted with the ground. A full-power climbout was continued under a slow turn to the left.

Suddenly the R70 pitched up a bit, and then all five motors cut out. An attempt to rearm the ESC was made, but the altitude was insufficient to save it. The bomber came down at an angle and made an impact nose first, with the front of the fuselage taking the majority of the contact.

The nose gear and front of the fuselage sustained minor damage. Coincidently, according to the history books, front landing gear problems were also experienced in 1918. So I guess I followed "scale" a bit too closely.

After making the necessary repairs, we performed additional ground range checks and experienced some radio-frequency interference problems. The five brushed motors created more of an electrical noise issue than I had anticipated. Long servo wires for the ailerons might also have been part of the noise.

I decided to purchase a Spektrum DX7 transmitter and Spektrum AR6200 receiver. Installing the 2.4 GHz system resolved all noise and servo interference. Keith and I tested the motors at full throttle and cycled the servos, with *no* glitches.

A few weeks later at the Mid-Am Electric Flies event in Northville Township, Michigan, I attempted a second flight. The field was in great shape, and Keith was at the controls again.

He applied full throttle and the Staaken rumbled straight down the runway. Liftoff occurred with a slow climb and large circuits around the field. Full throttle was required for most of the flight; there is considerable drag on this airframe.

Keith made a few passes and a couple clicks of trim adjustment. The slight breeze greatly affects the bomber's light wing loading, and rudder input was required throughout the flight.

After a few minutes, the aircraft came in on the approach and settled in smoothly. An hour later, under slightly less breezy conditions, the second flight was longer and Keith was able to back off a bit on the throttle.

I thank Keith, Jim Young, C.J. Wysocki, Bob Foran, Frank Jaerschky, Charlie Bice, Rick Cornell, Rick Allen, and many others who have supported me throughout this project.

A special thank you to my wife, Deb, and daughters, Rachael and Jordynn, for their support and tolerance of the many hours I spent in the basement building the Zeppelin-Staaken. MA

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Sources:

Manzano Laser Works
(505) 286-2640
www.manzanolaser.com

Du-Bro
(800) 848-9411
www.dubro.com
Hitec
(858) 748-6948
www.hitecrcd.com

BP Hobbies
(732) 287-3933
www.bphobbies.com

GWS USA
(909) 594-4979
www.gwsus.com

Spektrum
(800) 338-4639
www.spektrumrc.com

Mid-Am Electric Flies
http://homepage.mac.com/kmyersefo

Castle Creations
(913) 390-6939
www.castlecreations.com

Electronic Model Systems/JOMAR Products
(800) 845-8978
www.emsjomar.com