BY BOB WALLACE

A semiscale park flyer of the golden-age German sport aircraft

1922 Stahlwerk Mark III

ALTHOUGH IT'S virtually unknown in the US, other than by historical-aviation enthusiasts, the Stahlwerk Mark III was a popular and successful sport aviation design in Europe during the 1920s and 1930s. Walter Rieseler designed the airplane in 1922, and it is sometimes referred to as the Rieseler R III.

Rieseler, a gifted German airplane pioneer and designer, has been all but forgotten in aviation history in spite of his numerous accomplishments. The Stahlwerk Mark III was one of his earliest aircraft. He became better known for his innovative autogiros and was credited in 1935 with designing and producing the world's first helicopter that featured twin counter-rotating blades.

In 1920 Rieseler, in partnership with his brother, formed a small aircraft manufacturing company in Breslau, Germany, called Stahlwerk. The Mark III, which was preceded by the Mark II and Mark I, was offered for sale in 1922, and it rapidly became popular among the sport-aviation community in Germany.

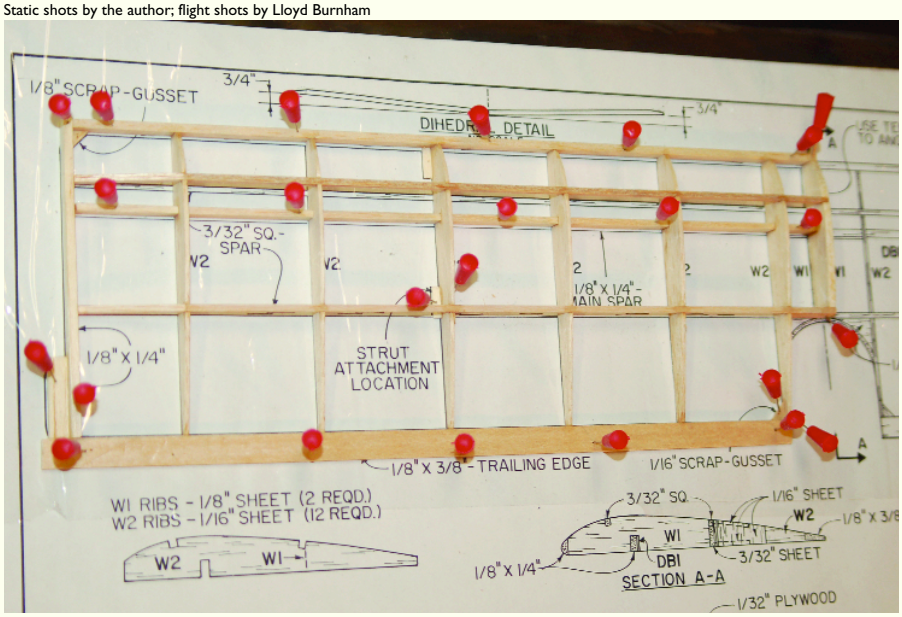
The Mark III was a small, single-place design with a fuselage length of 17 feet and a wingspan of 25 feet. It was powered with several different air-cooled engines, the most popular of which were the Haacke HFM two-cylinder flat opposed type that produced 26 horsepower and the Anzani three-cylinder radial that produced 30 horsepower.

The airplane's maximum speed near sea level was 66 mph, and it had a 62 mph cruise speed. With its low wing loading the Mark III had great short-field takeoff-and-landing capabilities. It could be airborne in slightly more than 100 feet, and it could be put back on the ground in an even shorter distance since its landing speed was just less than 30 mph. Its large-diameter landing-gear wheels were well suited to grass fields.

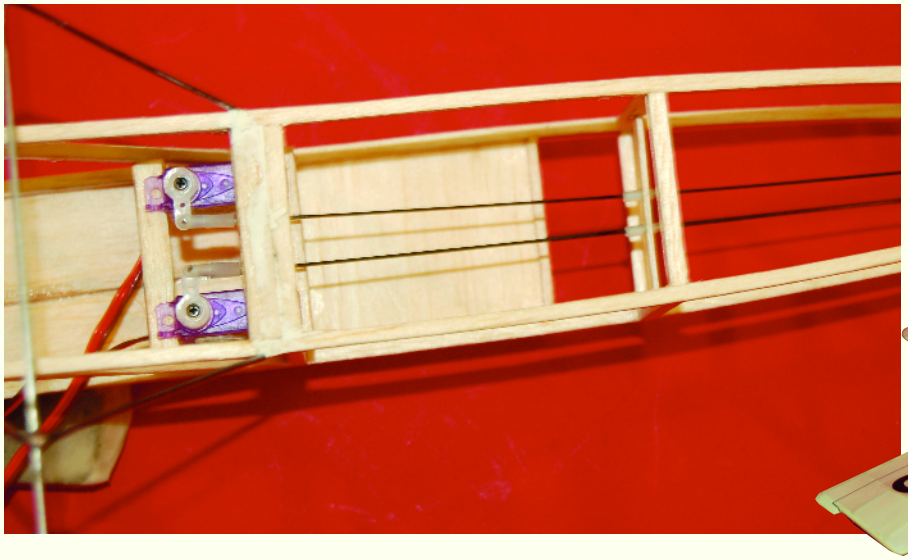
In 1923 a publicity seeker named Antonius Raab made one of the Mark III's most publicized flights. He landed his

Fly the Stahlwerk indoors or out. The outrunner motor system is quiet and provides enough power for a five-minute flight on a two-cell Li-Poly battery pack.

Static shots by the author; flight shots by Lloyd Burnham



The constant-chord wing uses the same rib shape at each station. The flat-bottom airfoil can be built on a flat surface with no fixturing required. Notice how the top spars meet the wingtip.



It's easier to install the rudder and elevator servos and control rods before the model is covered. A 6-gram submicroservo with roughly 10 inch-ounce of torque is all that is required.

Before sheeting the top of the fuselage, temporarily glue an incidence template in place to build the wing support. Round all balsa parts before assembling the structure.

aircraft on the Unter den Linden, which is a main thoroughfare in Berlin, Germany. The police promptly arrested him.

At least one Mark III still exists. It is on display at the Arlanda Aerospace Museum in Stockholm, Sweden.

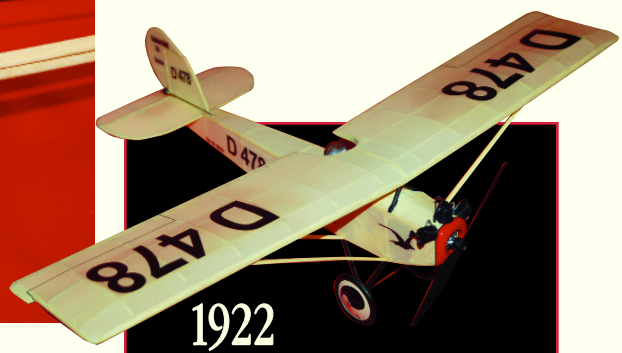
I selected the Stahlwerk Mark III as an RC modeling project because it's unique. More importantly, it produced dimensions and a planform that I hoped would result in a model that would be easy to build and fly and offer good flight characteristics.

Perhaps RC modelers who have never built a stick-and-tissue-type model will find this construction project to be one of interest and give it a try. It uses simple, proven building methods that require no unique tools or building skills. Older modelers who grew up eagerly constructing Comet and Megow kits and chewing Lepage's or Ambroid glue off their fingers may find the Mark III to be a trip down memory lane.

The intent in designing this model was to keep it simple using inexpensive and readily available construction materials most hobby shops should have in stock. My Stahlwerk Mark III is powered by a Baby Bullet Double Cool Wind brushless outrunner motor from CustomCDR.

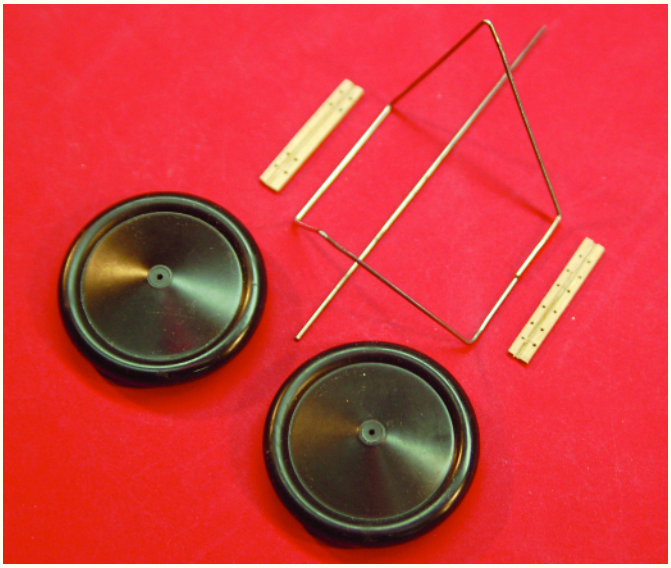
CONSTRUCTION

As with any plans- or scratch-building project, it helps to fabricate all the shaped or formed parts before starting the assembly

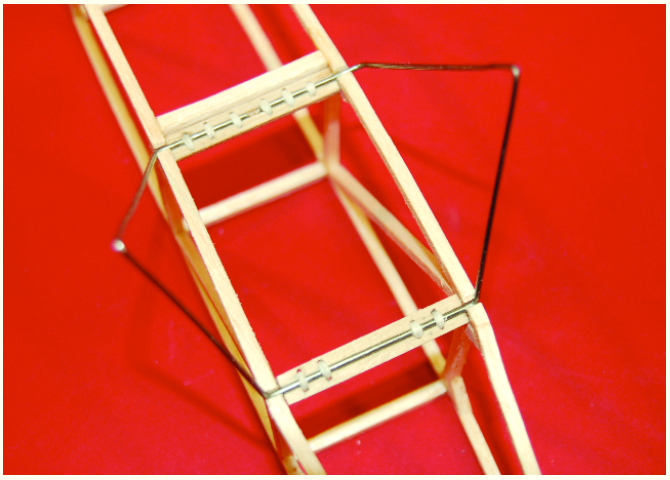


1922 Stahlwerk Mark III

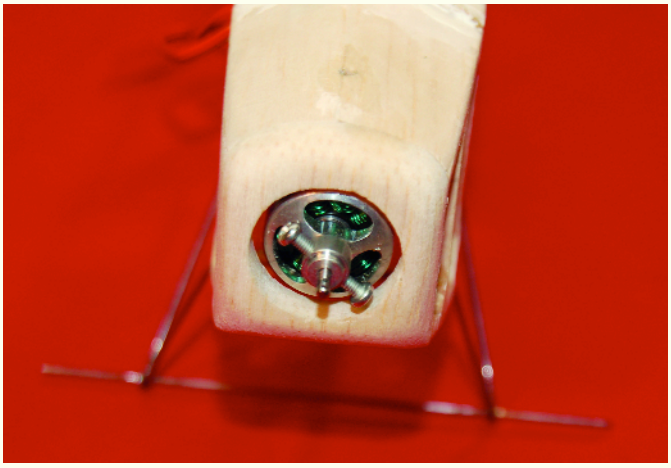
Type: Small vintage sport scale
Wingspan: 24 inches
Flying weight: 116 grams (4.1 ounces)
Wing area: 105 square inches
Length: 16.5 inches
Motor: Small microsize brushless outrunner
Propeller: GWS 6 x 3
Battery: Two-cell, 300 mAh Li-Poly
Construction: Balsa and plywood
Covering/finish: Polyester tissue (Litespan)



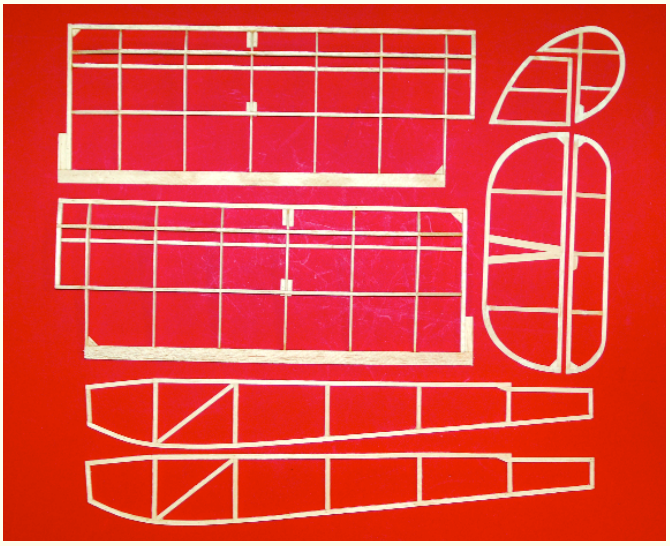
The landing-gear structure is fabricated from two pieces of .047 ($^3/_{64}$ inch) music wire. Guillow's 2-inch lightweight plastic wheels are used.



The landing gear is stitched to the airframe with button thread. The axle is attached with fine copper wrapping wire and solder.



The CustomCDR Baby Bullet (Cool Wind) brushless motor weighs just 16 grams and has a thrust output of approximately 12 ounces.

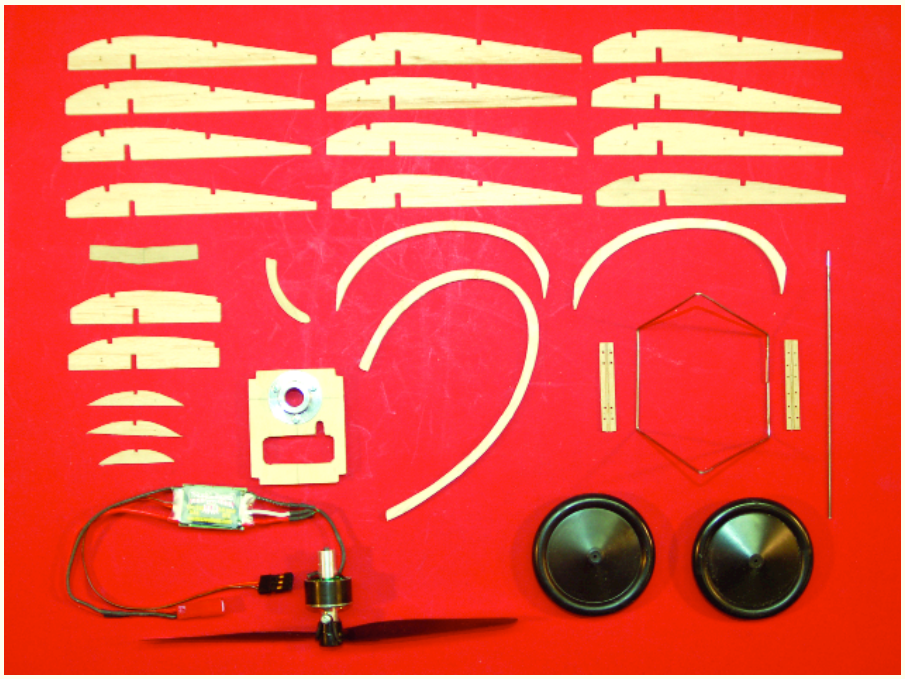


The number of shaped or formed parts required to construct a Stahlwerk Mark III is minimal.

process. That way the model's construction seems to go more smoothly and uninterrupted.

I did not prepare a list of required materials because most modelers who possess at least some building experience will have most, if not all, of the various-size wood pieces in their spare-wood supply box. Some of the sizes indicated do not require a full sheet, and the hardware needed is minimal.

Some modelers with built-up model construction experience know that using a balsa stripper greatly simplifies the material-acquisition process. With this tool all the stick stock can be cut easily from sheet stock to any custom width needed. I used a Jones balsa stripper, which is considered to be the Rolls-Royce of balsa strippers, but an inexpensive version such as Master Airscrew's will work fine.



Cutting the 11 balsa wing ribs is easy and rapid if you first make a rib master template from plywood, aluminum, or plastic.

Although it is optional, you can give your model a more scalelike appearance by adding 1/16 x 3/16 balsa to the landing-gear assembly legs.

The author made the decals on his Stahlwerk using a home-computer ink-jet printer and water-transfer decal sheets.

The number of shaped or formed parts required to construct a Stahlwerk Mark III is minimal. Since the wing is a constant-chord type, cutting the 11 balsa wing ribs is easy and fast if you make a master template from a scrap piece of 1/32 plywood, thin sheet aluminum, or plastic.

The motor-mount former is cut from 1/8 light plywood. Its height and width may vary a bit depending on what type of motor you use and where that former will be positioned within the nose portion of the fuselage.

The only other shaped parts that need to be cut are the 1/16 plywood tail skid, two 1/16 plywood landing-gear mounting crossbraces, three 3/32 sheet top fuselage formers, and the 1/16 plywood wing-spar brace.

The main components are constructed directly over the plans sheet placed on a flat building surface. Fledgling builders are reminded to place a sheet of clear vinyl plastic (backing from many heat-shrinkable film-type covering materials works well for this) or good, old kitchen-variety waxed paper over the plans sheet to permit easy separation of the assembled part from the sheet.

Wing: To construct each wing panel, pin the 1/8 x 1/4 main spar in place along with the 1/8 x 3/8 TE. Use the wing ribs to achieve the proper lateral spacing. Pin all the wing ribs in place. Be sure to cant the 1/8 center-section rib using the wing-dihedral-angle template as a guide. Glue these pieces together with thin cyanoacrylate adhesive, and then pin and glue the 1/8 x 1/4 LE and

Scale Documentation Sources

- www.histaviation.com/Mark_R_III_colour_profile.jpg
- http://aircraftwalkaround.hobbyvista.com/rieseler/rieseler.htm
- www.histaviation.com/Stahlwerk_Mark_III.html MA

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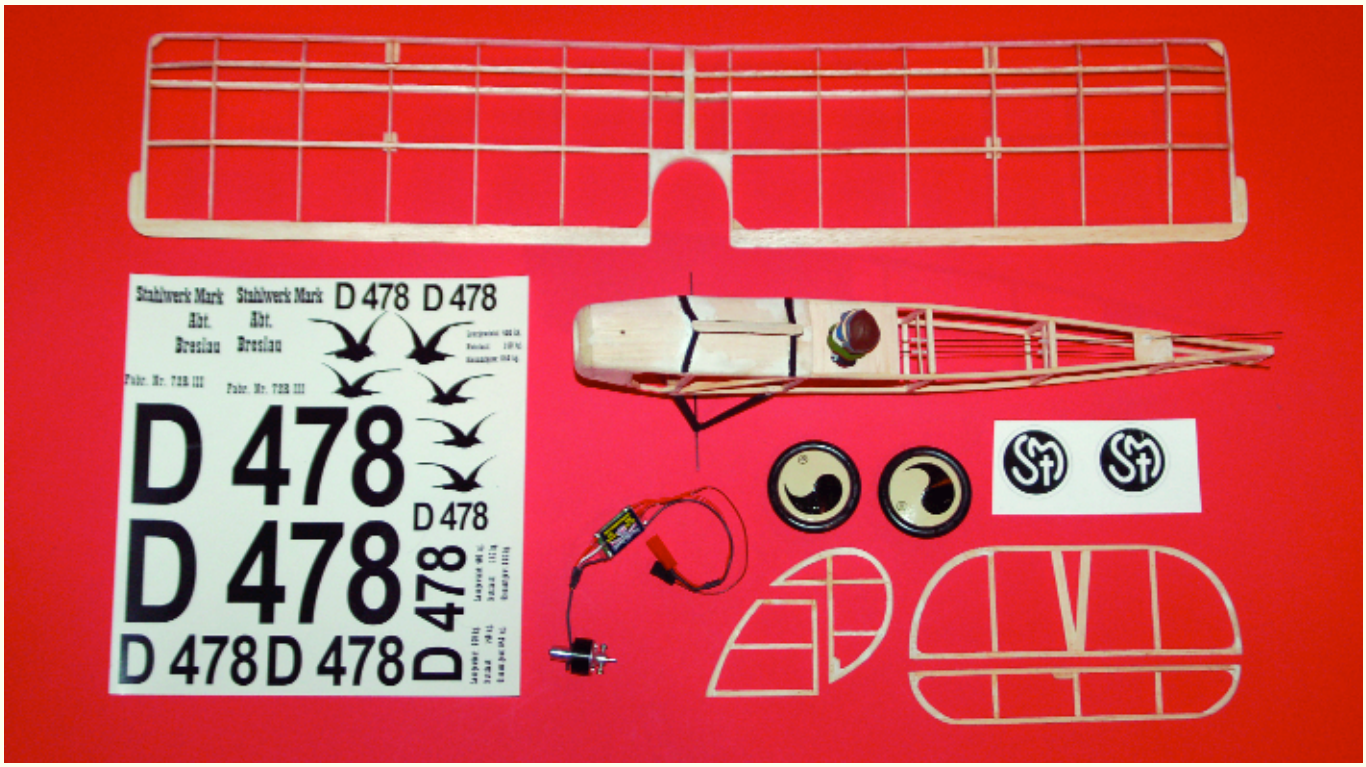


The tail surfaces are constructed from balsa stick and sheet stock. The curved perimeter pieces are made from laminated 1/32 balsa sheet.

two 3/32 square top spars in place.

Pin and glue the 1/8 x 1/4 wingtip pieces in place. The two 3/32 square top spars are cut at the outer W2 rib and angled downward to the 1/8 x 1/4 tip; see Section B-B on the plans sheet.

Glue the gussets and 1/16 x 1/8 wing-strut attachment pieces in place. It is easier to install the center-section cockpit-recess 1/16 sheet trim pieces after the two wing panels have been joined.

After both wing panels have been fabricated, lightly block-sand the faces of the canted center-section W1 ribs and trial-fit them to ensure that the indicated dihedral angle (3/4 inch under each tip) is produced. Glue the two wing panels together, and then install the 1/16 plywood DB1 brace.

Install the 1/16 sheet cockpit-recess pieces in the aft center-section recess. The completed wing assembly can be sanded and contoured to the indicated airfoil and planform.

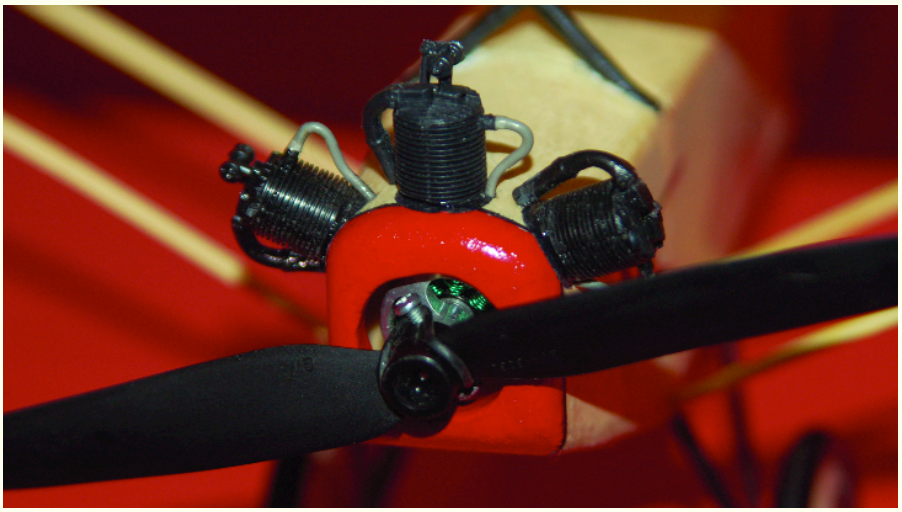
Tail: The tail surfaces are constructed from balsa stick and sheet stock. The curved perimeter pieces are made from laminated 1/32 balsa sheet.

Three pieces of 1/32 balsa sheet are glued together, with the center piece positioned cross-grain to provide additional strength, and then the curved perimeter tail-surface pieces are cut from this laminated balsa sheet stock.

Fuselage: The basic fuselage is a box-type structure that is composed primarily of 1/8 square balsa to make its open framework. The two fuselage sides are constructed directly over the plans sheet side view, and then the various 1/8 square crossbraces are installed using the plans sheet top view as a guide.

As I mentioned, the size and position of the 1/8 light-plywood motor bulkhead may vary depending on what type of motor, propeller mounting adapter, and motor mount you choose. I also mentioned that I used a Baby Bullet brushless motor, but a variety of other motors can be employed.

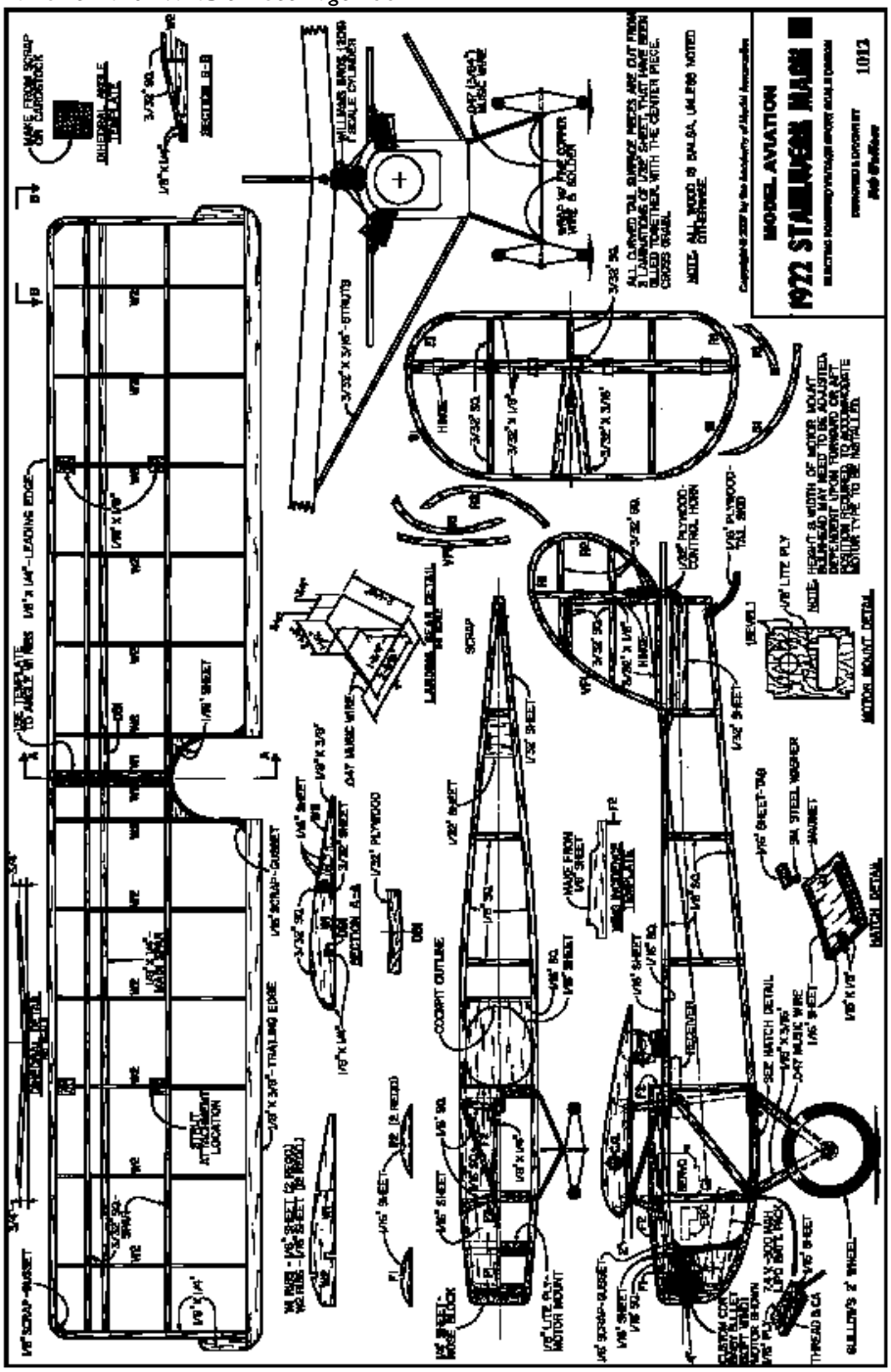
Any lightweight film-type covering, such as silkspan, or tissue-type materials can be used. A Williams Brothers 1/12th scale racing pilot bust was cut down to fit and painted.



Three Williams Brothers plastic Gnome engine cylinders (item 206) were trimmed and mounted to resemble the Anzani engine used on most Stahlwerk Mark III aircraft that were produced.

Using Litespan requires that a heat-sensitive adhesive be applied to the various components before covering.

Full-Size Plans Available—See Page 199



Mine weighs 16 grams and has a thrust output of roughly 12 ounces using a 2S Li-Poly battery source and 7-inch propeller.

After installing the motor-mount bulkhead, 1/16 nose-sheeting inlays, and 1/8 scrap bulkhead gussets, fit and secure the fuselage F1 and F2 top formers, 1/16 square stringer, and 1/16 top sheeting.

To ensure that the wing-mounting pylon structure is constructed at the proper incidence angle and aligned correctly, use the incidence template shown on the plans sheet as a guide.

Using a piece of string or thread, along with a couple pins or a flexible straightedge, determine the fuselage centerline and lightly mark it along the top sheeting between the F2 fuselage top formers. Pin the 1/8 sheet incidence template onto the fuselage top sheeting along the marked fuselage centerline between the F2 formers.

Once the 1/8 x 1/4 wing-support portion of the pylon is pinned in place on top of the template, the 1/8 and 1/16 square pylon support pieces can be cut, fitted (notching the top sheeting as required), and glued in place. Since the full-scale Stahlwerk's pylon support pieces were made from welded steel tubing, it is easier to sand the 1/8 and 1/16 square pieces round before cutting them and fitting them in place.

After you have glued the wing pylon structure in place, remove and discard the incidence template.

The landing-gear structure is fabricated from two pieces of .047 (3/64 inch) music wire. One piece is the 4-inch-long axle that will ultimately be trimmed to accommodate whatever type of wheel you choose. I used Guillow's 2-inch lightweight plastic wheels on my Stahlwerk.

The main landing-gear structure is bent to shape using the detail shown on the plans sheet. Then the landing-gear structure is mounted on the two 1/16 plywood crossbraces using button thread and cyanoacrylate adhesive.

A 1/16 cap piece of balsa is applied over the laced-on landing-gear/plywood crosspieces to provide a finished appearance after being installed on the fuselage. The axle is attached to the main landing gear with fine copper wrapping wire and solder.

Although optional, you can attain a more scalelike appearance by adding 1/16 x 3/16 balsa to the landing-gear-assembly legs. I did this by cutting a small channel along the balsa strips and then gluing them in place with cyanoacrylate. After sanding a radius on the legs, I painted the landing-gear assembly with satin-finish black paint.

The fuselage bottom access hatch is fabricated using the hatch detail shown on the plans sheet, and it is held in place with a small magnet. Glue the 1/4 sheet nose block in place and sand the fuselage assembly to the indicated contours.

Notch the fuselage to accept the 1/16 plywood tail skid, but do not permanently install the tail skid until after you cover the model. Also, it is easier to install the rudder and elevator servos and control rods now rather than after the model has been covered.

The wing struts are made from 3/32 x 3/16 balsa and have their edges rounded. The wing, tail surfaces, and fuselage assembly can be fine-sanded in preparation for covering. Any minor surface imperfections can be filled with lightweight filler.

Covering: Any lightweight film-type covering, such as silkspan or tissue-type materials, can be used to cover this model. I used buff-colored Litespan, which is a lightweight, heat-shrinkable polyester tissue-type covering that closely resembles the natural linen-type material used on many aircraft during the 1920s, including the Stahlwerk.

Using Litespan requires that a heat-sensitive adhesive be applied to the various components before covering. I used Coverite Balsarite. The adhesive is brushed onto the various subassemblies wherever the covering material needs to be heat-fastened.

Once the Balsarite has dried, the Litespan can be applied in the same manner as any other heat-shrinkable covering material. In areas where covering material overlaps, the joint needs to be coated with Balsarite.

The decals shown on my Stahlwerk were made using a home-computer ink-jet printer and water-transfer decal sheets. These decal

sheets are readily available at graphic-arts supply outlets or from a variety of Internet sources. The sheets I used were purchased on eBay and cost roughly one dollar each.

I trimmed three Williams Brothers plastic Gnome engine cylinders and mounted them on my model to resemble the Anzani engine that was used in most of the Stahlwerk Mark IIIs. Although they are not true scale, the World War I-era Gnome cylinders resemble those on the Anzani; I do believe they enhance the model's overall scale appearance.

To complete the power package I equipped the Baby Bullet brushless motor with a GWS 6 x 3 propeller (item GW/EP6030), a Castle Creations Thunderbird-9 ESC, and an Apache 7.4-volt, 300 mAh 20C Li-Poly battery pack. I used an Airtronics RD6000 transmitter, and the airborne radio system consisted of a Corona RS410 single-conversion microreceiver and two Blue Bird BMS-303 microservos.

I achieved the indicated CG on my model by positioning the operating components as shown on the plans sheet. My Stahlwerk, ready to fly, weighed 116 grams (4.1 ounces).

Flying: A beautiful, mild spring day with sunny skies and only a wisp of a breeze proved to be ideal conditions for my Stahlwerk's test flights. Since our club flying field is all grass, and the Stahlwerk is equipped with relatively small-diameter wheels, I decided to hand launch for the maiden flight.

After a usual radio range check and final inspection, it was flip-and-fly time. Standing stationary with approximately two-thirds throttle introduced, a light, straight-out toss was all that was necessary for the Stahlwerk to climb out nicely.

After gaining roughly 75 feet of altitude, a few blips of right rudder and down-elevator trim correction made the Stahlwerk fly hands off. I spent the next several minutes flying about, performing mild maneuvers at various throttle settings to assess the model's in-flight capabilities. It became apparent that a bit more rudder and slightly less elevator control-surface movement were needed.

The first landing was easy and uneventful. With the motor throttled back to approximately one-quarter power, I made a shallow, gentle approach until the Stahlwerk was a few feet above the grass surface. The landing stall occurred predictably after easing back the throttle to idle, which resulted in a soft landing.

Since the Stahlwerk is a small, lightweight aircraft with a low wing loading, landing on grass could best be described as a three-point plop rather than a conventional landing. There is no rollout once the wheels make contact with the grass!

After making the required control-surface-movement adjustments, I installed a fresh battery pack and the Stahlwerk was airborne again and flying quite nicely. It is easy to fly and forgiving, with no bad in-flight characteristics. Its mild aerobatic

capability proved to be suitable for this type of model. The well-built Baby Bullet proved to be an ideal choice, with outstanding power.

Subsequent flights were in the 10- to 12-minute range using an Apache two-cell, 300 mAh Li-Poly battery pack. The recommended control-surface travel limits, in each direction, are three-eights rudder and one-quarter elevator. Those are suggested starting points, and those who decide to build a Stahlwerk may ultimately decide to alter them a bit to suit their flying preferences.

Although I have not had the opportunity to fly my Stahlwerk indoors, I am sure I will when what is referred to as the "building season" (winter) arrives in New England. Since it is slow-flying, docile, and easy to fly, it should be well suited for indoor flying.

The Stahlwerk is an easy-to-build sport-scale model that is a bit different. It is well suited to those who would like to try a traditional stick-and-tissue-type built-up model. Experienced modelers who are looking for a project that will renew pleasant memories of a time that may well become known as the golden age of model aviation should also find this to be a worthy subject.

If I can be of help in answering any questions relative to how I built my Stahlwerk, I will be most willing to do so. My address is 91 Sylvan St., Avon CT 06001. MA

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Sources:

Baby Bullet Double Cool Wind motor:
CustomCDR
1215 Diamondback Dr. NE
Albuquerque NM 87113
www.customcdr.com

Castle Creations Thunderbird-9 ESC:
(913) 390-6939
www.castlecreations.com

Battery pack, servos, receiver, covering material:
BP Hobbies
(732) 287-3933
www.bphobbies.com

Master Airscrew Balsa Stripper:
(916) 631-8385
www.masterairscrew.com

Jim Jones Design Balsa Stripper:
A2Z CNC
(877) 754-7465
www.a2zcnc.com/airplane.asp