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BUILDING THE SKYSHARK R/C MESSERSCHMITT 109E FOR ELECTRIC POWER

THE CHALLENGE

Several years ago at TOP GUN, I was walking across the field after a day of competition flying with the ¼ scale electric powered 1941 Taylorcraft I developed expressly for that purpose. One of the world's best known scale designer/fliers was beside me, chatting about scale flying and especially the future of electric power, and he gave me a challenge. "Bob", he insisted, "These lightplane jobs you've got are OK, but for *all* the guys to take this electric power thing seriously, you've gotta build a big, nasty World War Two fighter, flaps, retracts and all, and then bring it out and fly the ---- out of it in front of everybody!"

That was a tall order, but it was also a challenge I couldn't refuse. Building and flying a scale model of one of those big, nasty WWII fighters was a good way to separate the men from the boys even before R/C flying as we know it today existed. When I built my first radio controlled airplane over forty years ago there were only a handful of kits for WWII

fighters on the market, and every one of them was seriously compromised by the limited and unreliable control systems of the day. Today's R/C systems offer features and functions we didn't even dream about *back then*, and they are so reliable that it's unusual to hear an experienced modeler talking about crashing due to radio failure. That leaves today's modelers with some happy choices to make. Forget about trying to find a subject that can be coaxed around the sky with limited control...now we can decide which of the classic designs we *really* want and actually build it using a tempting array of goodies from the local hobby shop, all of which *work*.

Electric flight technology wasn't quite up to the challenge that day at TOP GUN, but it is now! The scale kits produced by Skyshark R/C represent a selection of the unusual subjects everyone *talks about* but few of us build. Their kit engineering is excellent, with sufficient accuracy that an experienced scale modeler could easily use one as the basis of a competition airplane. That's not all...the strong, light structural design means that conversion to one of those cutting edge electric systems requires nothing more than putting a motor and battery where the engine and tank used to be. I've done it. I have the same performance and duration I would have had with a glow engine...at the same weight...and in cooperation with *Fly R/C Magazine* I'm here to tell you all about it.

THE AIRPLANE

The Messerschmitt Bf-109 (or Me-109, depending on how you interpret the historical references) has always been considered one of the classic fighters regardless of which

side you happened to be on. As the Skyshark catalog says, *“The ME109 was the standard by which all other fighters of WWII were judged. It served the Luftwaffe in almost every capacity, from interceptor to night-fighter to ground attack and photo reconnaissance. The ME109 was produced in greater numbers than any other plane (approx. 30,000) and has remained in use by some countries until 1967. The E version was the first large scale production of the 109. Germany began production of the ME109E in early 1939 beginning with the E-1 version. Many of these aircraft were assigned to Spain with the Condor Legion and proved their vast superiority in almost every category. Armament included a pair of cowl-mounted 7.9mm machine guns along with a pair mounted in the wings. The E-3 variant incorporated an MG ff cannon between the engine cylinders that exited through the spinner. Problems with jamming and overheating forced the redesign of the gun in the designation change to E-4. This gun was removed in the later E-5 and E-6 versions. Early 109s used a Daimler-Benz DB601 engine that produced 1175 hp. The later versions used a DB601Aa engine that produced 1200 hp and had a max speed of 290 mph. The maximum range on the E-4 version was 410 miles.”*

The several –E variants, loved by the Luftwaffe pilots who referred to them as their *Emil*, are considered to be the classic German *Battle of Britain* fighter, the deadly opponent of the RAF’s Hurricanes and Spitfires. The *109* has also been considered *too difficult* by generations of model builders who knew better than to risk their time on a model with that narrow, spindly looking landing gear that was a ground loop waiting to happen. The master modelers who could actually scratch build one also understood that those *tiny* tail surfaces at the end of a long, skinny fuselage *would not work* without

precise and reliable radio control and pilot skills to match, and the Bf109 earned a reputation as a poor choice for even the most serious scale modelers.

AN EASY HISTORY LESSON

It used to be that converting a model designed for glow power to electric was an experts-only project. We did it *back then* because in the early days of electric flight there weren't many e-power kits of any sort on the market. If you wanted something other than a powered sailplane or a lightly loaded sport/trainer you had to design your own, build from plans (if you could find them)...or...you could convert a *gas kit*. Typically that meant replacing a lot of heavy, clunky balsa structure and *lite ply* with top quality lightweight balsa, cutting lightening holes just about everywhere, and redesigning a lot of structure so you could mount your electric motor and (big, heavy) battery pack. If you knew how to choose a design that would fly well at a weight significantly heavier than advertised and you could select the right motor-gearbox-battery-propeller combination, you could do it...but it was not easy.

Things sure have changed! The most obvious difference today is the ready availability of direct drive *outrunner* brushless motors and practical Lithium Polymer (LiPo) cells. Not only can a LiPo battery perform with a power to weight advantage as high as *five to one* over the old nickel chemistry cells...the new generation of motors includes some really BIG ones that will run at currents as high as fifty or even sixty amps on LiPo batteries that will deliver that much energy safely. What this means is that just about any airplane

designed for glow or gas engines is now fair game for e-power. The *weight penalty* is GONE and so is the limited flight duration that used to be part of electric flight. Thanks to the efficiency of the large, relatively slow turning propellers for which the new motors are designed, there are plenty of electric airplanes flying today that perform *better* than they would have on an equal weight of glow engine and fuel.

In the *bad old days* most R/C models, especially scale jobs, were overbuilt (and overweight) in anticipation of the unpleasant results of having to fly with unreliable radios. Modern radio control systems are so dependable that it makes sense for serious modelers to invest the time and effort necessary to develop sophisticated flying skills and collect their reward by flying lighter, more interesting models that can be expected to last for years. Today there are plenty of kits designed for electric power on the market and more than a few warbirds among them, but even now big, accurate R/C scale *electric* versions of the classic fighters of WWII are hard to find.

SKYSHARK'S KIT AND MY ELECTRIC INSTALLATION

The folks at Skyshark R/C were paying attention while all this was happening and they realized that nearly all the WWII fighters could now be flown safely in model form by experienced R/C pilots. They made the decision to break new ground by developing kits for subjects beyond the ever popular (and ever common) P-51, P-47, Spitfire, etc., etc. CAD (Computer Aided Drafting/Design) and precision laser cutting have made it practical to plan short production runs that would have been economically disastrous with

the old die-cutting technology. Skyshark took a chance with a whole series of those less common and *really interesting* designs that everyone talks about and nobody builds, and all of us who love scale model airplanes are the richer for it.

These kits are expertly engineered and exquisitely produced. An experienced model builder can easily turn one into a good looking airplane that flies well, too. Like her sister designs, the Bf-109 E is not intended to meet the standards of accuracy you'd expect to find at Scale Masters or TOP GUN, but Skyshark suggests that with a bit of extra work that kind of finesse is possible with their kits. I have competed at that level, and I agree. The critical factors for getting a scale kit right...the outline and cross sections...are pretty close. It's up to the individual builder to decide how far to go with fine detail.

There's even more to be excited about. This kit was originally designed for glow engines in the .60-.90 displacement range. Then, at about the same time I was working out the details for my electric installation, Skyshark announced that they were going to take a step other kit manufacturers would do well to follow. They now sell *complete electric power systems* carefully selected to fit each of their designs. I think we should call this the *electric power option*, not the *electric conversion*. With this kit there isn't much to convert. You just build the nose and motor/engine mounting structure to fit your motor and make space for a battery pack instead of a fuel tank. That's it! It works, and you don't have to sweat out getting the details of the e-power installation right...just order it from Skyshark R/C already planned and packaged to fit the model you are building.

Based on an AXI 4130-16 brushless outrunner motor, the *AXI08* combo suggested for this airplane includes a Jeti JESAP90PW Advance PLUS 90 ESC (Electronic Speed Control), all necessary wiring and connectors, and a proprietary *Perfect Balance* LiPo (Lithium Polymer) battery pack that permits the motor to operate on the voltage of six LiPo cells while providing a total current capacity of 8000 mAh. Propellers from 14x10 to 16x 10 will work best. Skyshark advertises this *Plug and Play* system as being equivalent to a .91 four stroke glow engine, with flight durations of 8 to 10 minutes.

I agree that this *109* will fly exactly as advertised on that power. However, when I began the project the *Plug and Play* packs had not yet been announced. I decided to use a bit more power than necessary in order to demonstrate an electric powered fighter with *outrageous* performance, and installed an AXI 5320-28 motor from Hobby Lobby International, Inc., running on an 8S1P BalancePro HD LiPo pack provided by FMA Direct. (See sidebar for FMA product info). I am flying on an 18x14 custom wood propeller from my secret stash of special electric props...*however...*a stock APC Electric 18x14 will work every bit as well, and the 5320-28 is capable of turning even larger propellers safely. My *109* takes off aggressively from grass at half throttle and at full power she would maintain a vertical climb right out of sight if I let her do it. Cruising flight and *scale* aerobatics such as BIG loops, rolls, chandelles, split S turns, and Immelmans are effortless without ever touching the throttle stick against the high end stop. I can fly the airplane that way and make only gentle demands on the motor and battery pack, but should I choose to do so I can also turn the monster loose without

hurting anything except the credibility of the guys who kept insisting that *it'll never work!*

BUILDING THE MODEL

The Skyshark R/C Messerschmitt 109E is not a project for beginners! The quality engineering and precision laser cutting guarantee a kit box full of some of the best model airplane components you can buy, but if you do not have the experience and skills to make balsa wood do exactly what you want, you will not be able to do it justice. Imagine one of those old time stick and former rubber power kits...now make it bigger, include the parts count and complexity necessary to provide strength and maintain the correct scale shape, and add sheet balsa skin where the full scale airplane used sheet metal. There it is...the best of traditional model airplane building meets state of the art technology to give you a truly enjoyable experience.

Enjoyable is the right word. I have built a lot of model airplane kits over the past fifty five or so years, and developed more than a few designs of my own. It is rare to find a kit for a complex R/C scale subject that doesn't require some second-guessing and creative problem solving, and of course designing your own means that you do *all* the work of figuring out how the pieces should fit together. Within a few hours of starting to build this airplane I realized that it was going to be different. I took the kit designer's word, followed the instruction manual to the letter, and encountered no problems. You must

understand how to fit, glue and assemble all those laser cut parts to build a truly accurate framework, and know enough about covering complex shapes with balsa sheet to replicate the appearance of an all metal airplane, but modelers with the requisite abilities will enjoy building the Skyshark Messerschmitt. Everything fits and everything works without your having to reinvent it. Skyshark got it right.

The builder has the choice of completing the 109 as a fixed gear sport-scale model or to include either or both of the landing flap and retract gear options. Building the flaps involves using several extra pieces of wing structure that are included in the kit, as well as an extra pair of suitable servos. Mounting blocks and formed wire struts for a fixed main landing gear are also furnished. The *109* does fly OK with the wheels down, but for me it would not seem right to build a heavy metal fighter *without* retracts. Skyshark specifies the Spring-Air #704 retract system. As I have had excellent results with Robart products in the past, for this airplane I chose the Robart #551RS85 main gear units along with a pair of #660 compression struts, 3 ½” diamond tread tires, and the comprehensive 188VRX air kit. *109*'s used fixed tailwheels, so no retract option is necessary there, and the main gear covers were simple one piece doors that left the lower half of each wheel exposed. Laser cut plywood wheel cover doors are included in the kit and I used them initially, but for better appearance I replaced them with a custom set cut from .030” aluminum alloy and bent into a gentle curve to match the underside of the wing.

109's used simple trailing edge flaps. Each flap was divided into a long outer and short inner section that moved independently of each other. Skyshark has simplified things for

you by designing each flap as a single piece and for a sport scale model I see no reason to change that. It would be simple for a builder with enough experience to be considering Masters-level competition to redesign them for accurate appearance. The flaps work. I use them on every landing, with full extension (40 degrees) as I turn onto final approach with the airplane a bit high and then let the moderate nose-down pitch provide a steep glide that ensures just enough extra speed for a smooth round-out over the end of the runway.

COVERING AND FINISHING

Skyshark has made some of the hard choices, but the builder still has a few decisions left. Full scale *109's* used sheet metal skin over an all-metal structure with fabric covered rudder, elevator and aileron surfaces. This kit employs quality 1/16" sheet balsa to reproduce the metal surfaces and uses *open structure* exactly where the full size airplane did. You have to decide how to simulate that fabric covering as well as how you are going to seal and finish the metal/sheeted areas.

The instruction manual reports that one of the kit prototypes was built and flown using an iron-on plastic covering. It also suggests that a finish of paint over a lightweight fiberglass cloth and resin base would be a good choice for this model. Those of you who know me won't be surprised that I chose the latter option for my Messerschmitt. Many years ago one of the master modelers of the '50's and '60's really got my attention when he stated in a magazine article that *once you have the structure built you are halfway to*

having your model ready to fly. Covering and finishing is every bit as important as building the structure and there is nothing wrong with taking the time necessary to do it right. In my opinion no plastic covering would provide the strength and durability, let alone the appearance, that this model deserves. I prefer to use an epoxy-glass surface over all closed (solid or sheeted) structures as a substrate for my paint finish. For my Messerschmitt I chose 0.75 ounce/sq. yard fiberglass cloth and applied it with Z-Poxy from Robart thinned 25% with denatured alcohol and brushed through the glass into the balsa.

The rest of the job gave me another opportunity to use what may be one of the most overlooked products in modeling...the Stits Lite covering and finishing system. F&M Enterprises makes the entire line of FAA approved full scale covering and finishing materials available to modelers, and I have used it exclusively on all my competition scale models for over fifteen years. If you have an interest in traditional fabric-and-paint finishes for your models, scale fighters or otherwise, you *need* to know about this stuff. Go to <http://www.stits.com/> for comprehensive information on how the *Stits Process* works.

On my Messerschmitt I used Stits materials *by the book*. I sealed the raw balsa of the open structure control surfaces with Stits *PolyBrush*, which is a non shrinking clear sealer. I covered the surfaces with *PolyFiber* fabric using *PolyTack* adhesive, heat-shrunk it exactly per instructions, added Stits pre-cut pinked reinforcing tapes around the edges, and sealed the whole fabric job with a couple coats of *PolyBrush*. Then I wet sanded the

epoxy glass surfaces, put on several coats of Stits *FeatherCoat*, a dense white sanding primer that adheres really well to resin composite materials. I completed the base finish with aluminum-based *PolySpray* applied everywhere, wet sanded and resprayed until I was satisfied with the results. My *109* is finished in the markings of the 2/3 *Jagdgeschwader* based on the French side of the English Channel in 1940, without attempting to replicate a specific aircraft. Except for the Luftwaffe 76 blue-gray, which required some mixing, PolyTone Oak Green, AgCat Gray and Piper J-3 OEM Yellow right out of the can came very close to matching my references. Skyshark provides a good selection of vinyl markings that work with a variety of different color schemes. I used them exactly as supplied and then gave the entire completed model a coat of matte clear PolyTone.

FLYING

You can't fake this part...you *must* have some experience with fast, low wing (aileron equipped) airplanes and you must be able to handle a taildragger with confidence, or the *109* will bite you. That does not mean there is anything wrong with the design. Skyshark has done it right and their *Emil* handles pretty much the way you would expect the full scale airplane to behave. Once it is properly trimmed and balanced, this model will fly hands off in unaccelerated level flight, but you need the pilot skills to get it up there and back to enjoy the ride. All ground handling should be done with full *up* elevator (stick back) so the prop blast will hold the tail down, and I have learned to hold that control for a second or so after going to takeoff power to prevent nosing over before the airplane has

enough speed to give the tail surfaces authority. This is standard full scale practice, as is getting *off* the elevator as the airplane accelerates to avoid forcing it into the air too soon. While all this is going on you will need plenty of right rudder to keep the nose pointed straight ahead, but once the *109* is in air she will go pretty much wherever you point her.

Landings are predictable. Lowering the flaps slows the airplane noticeably and produces a slight nose-down pitch that I find just right for setting up a steep approach glide. If you are new to electric power you must remind yourself to keep a few *clicks* of throttle ON all the way through landing. Unlike combustion engines which keep their props turning at a considerable rate while idling, *full low throttle* on an electric job is *so low* that there is no appreciable prop blast over the rudder and elevator. If you forget it'll seem as though you have no control authority left just when you need it at touchdown. With all that taken into account, my airplane lands best if I fly her onto the strip just a bit fast, tail up, in a classic wheel landing. Three point (full stall) landings risk getting just a bit slow and dropping the last few inches.

I LIKE THIS AIRPLANE BECAUSE...

If had built this airplane without knowing anything about electric power, with a good glow .90 in the nose and the engineering finesse Skyshark R/C has put into a scale model *designed to fly*, I would have been well pleased. The option of building it for electric power makes it even better. The sound of a big electric job is a confident, hushed note

that barely carries beyond the flight line, there are no ungainly model engine bulges to spoil the shape of the nose, and the power system runs squeaky clean and satin smooth. Using the pre-selected e-power components available from Skyshark, you can have all these advantages with none of the old penalties of extra weight and short flight duration. If you have the modeling experience to do justice to a built-up balsa structure and the pilot skills to handle one of those big, nasty World War II fighters, try this one. You'll like it, too!

PHOTO CAPTIONS:

- (1) The quality of the laser cutting in this kit is as good as I have seen.
- (2) You start building the wing by gluing plywood reinforcements to the appropriate ribs and pre-mounting the flap and aileron servos. Socket head screws and access covers permit removal for service.
- (3) You build the center section first, then prop it up so you can build the first outer panel with the spars flat on the board.
- (4) Here the left wing has been built and the top sheeted. The entire assembly is rotated and blocked in place to build the right wing.
- (5) You pre-assemble complete wing skins from 1/16" balsa sheet and then glue them in place with each panel flat on the board. I use aliphatic resin (Titebond) wood glue to ensure plenty of time to get everything properly aligned. The lead building weights guarantee that it all stays straight while drying.

- (6) Rib tabs on the horizontal stabilizer provide alignment during assembly.
- (7) Building the fuselage starts with frame (crutch) that splits the structure into top and bottom assemblies.
- (8) After all the top formers are glued in place on the crutch, those four alignment blocks are removed.
- (9) The fuselage top assembly gets sheeted with 1/16" balsa, then you turn it over to assemble the bottom formers.
- (10) It helps to have good supervision while you get everything properly lined up. *Miss Charlotte* knows how...she has watched quite a few airplanes go together on *her* bench.
- (11) The horizontal stabilizer of the *109* is located partway up the vertical fin. Here the stab is glued in place on the fin base; the rest of the fin will attach above it. A shaped balsa block fills the complex curvature where the fin leading edge will meet the aft fuselage.
- (12) *Let me out of this hangar!* The Robart retracts and compression struts show up well here. The molded fiberglass radiator housing behind the wheel wells are provided with the kit. I cut out the front and rear faces and inset sections of plastic combs trimmed to fit to simulate radiator grilles. The chin and oil cooler openings are scale...I used them as functional cooling intakes.
- (21) There's a lot going on here... The standard kit engine mount is a plywood box that extends back through two plywood formers. I extended it about 3" to line the AXI 5320-28 up with the front of the cowl and then cut out the top to create an easily accessible battery box. The kit nose cowl is a one piece fiberglass molding designed to be screwed to blocks on the firewall former. I cut across it at the scale parting line, attached the

bottom section permanently, and made the top shell removable for easy access. The two black LiPo packs slip into the opening behind the motor and onto short strips of Velcro that keep them from moving around.

(13) Here's the next part of the electric installation. Plenty of cooling air comes in through those nose openings. I made several large holes in the former that serves as the front wall of the cockpit so air can move back through the fuselage, then removed the "glass" from the triangular sections at the rear of the canopy to let it out.

(14) Cowl off for service! I am pressurizing the retract gear air tank using a Robart hand pump.

(15) *Are we supposed to be friends?* My good friend Gary Ritchie, who did all the action photography for this article, parked his 1/6 scale P-40-E with RNZAF markings next to an old adversary.

(17-18) Takeoff run...My Emil gets off the grass in a hurry. Coming at you, the *up elevator* that keeps all that power from causing a noseover is just visible. A second later I am backing off the UP and holding LOTS of right rudder as the authority of that big propeller makes itself felt.

(19) Low and sort of slow, there is no appreciable trim change with the wheels *down*, but the airplane goes faster with them up.

Out looking for trouble. It's not hard to imagine how this would have looked from the cockpit of an RAF fighter in 1940!

Kit data: Specifications:

- 1/6th Scale
- Wingspan: 64.8 inches
- Wing Area: 719 Sq. In.
- Flying Weight: 7 to 9 lbs.
- Engine Size: .50 to .61 2-stroke, .60 - .91 4-stroke
- Building Experience Recommended: Intermediate
- Flying Experience Recommended: Previous low or mid wing experience
- Recommended Electric Conversion: [AX108](#) with 16x8 APC prop.
- Recommended Glow Power: [RCV .91 4-stroke](#)