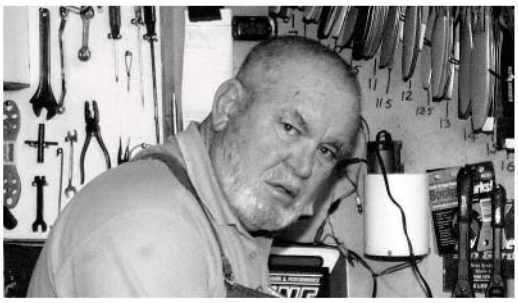
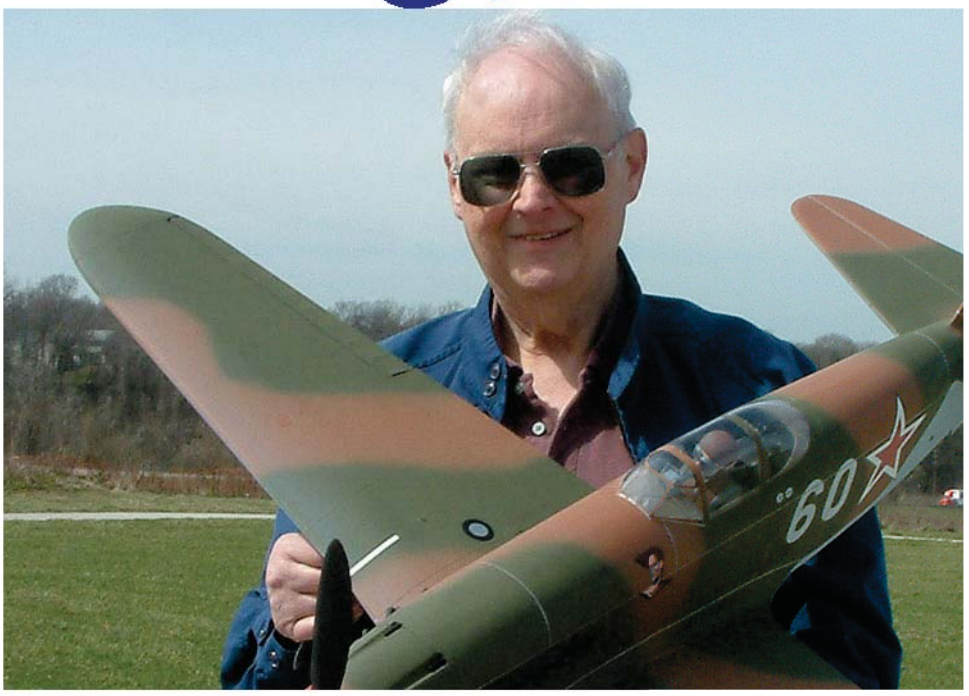
April Issue 273

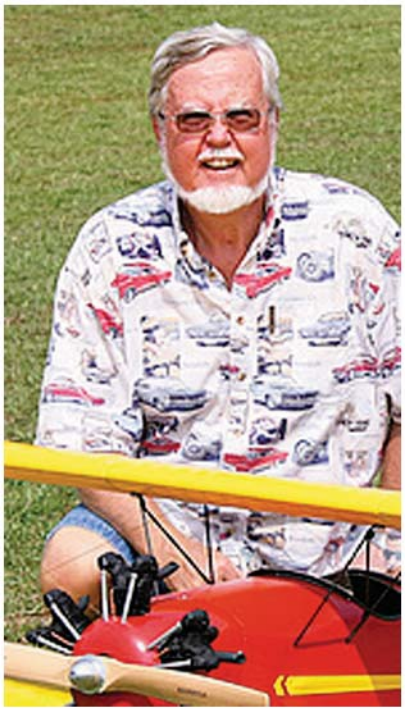
RC REPORT Online!

Offering unbiased product reviews and informative articles for radio control aircraft enthusiasts around the globe





The "GANG"



R/C REPORT ONLINE
APRIL 2009

COLUMNS

PRODUCT TEST REPORTS

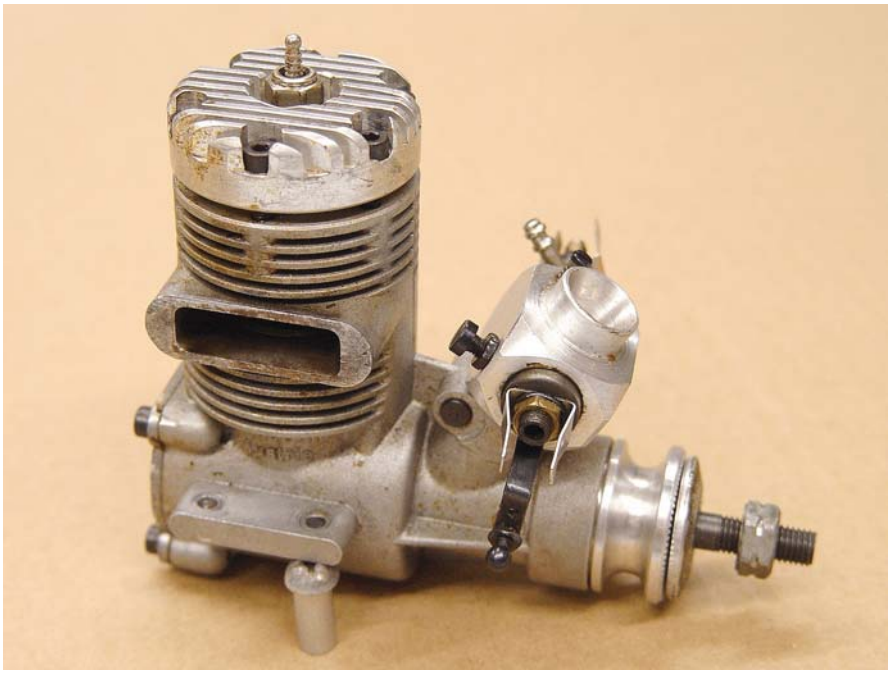
lines from the editor

I've always liked the old K&B .61's. They were pretty good .61's, but they are so light in weight, they make *great* high-performance .45's! This photo shows only my incomplete K&B .61's.

REVIVING OLD GLOW ENGINES AFTER LONG TERM STORAGE

Once the printed version of *"R/C REPORT"* magazine came to an end, the steady influx of cool new test products naturally died right along with it. This was very upsetting to my deep rooted habit of working long days in the office and long nights in the work shop. The office hours habit took care of itself because closing a 23 year old business and writing several thousand subscription refund checks takes a lot more time than I anticipated. But how was I to fill those much-needed hours of mental and spiritual therapy spent in my hallowed and beloved work shop? There were no new airplanes to build, no new engines to test, and no new radios to study. What to do, what to do? Luckily, a few kits that were purchased for review projects way back in the mid-80's had never been done, because less than a year after *"R/C REPORT"* was born, we began buying, begging, and borrowing the kits and other products that were often requested by our readers. A few of the kits we'd bought early on were so rarely requested, they got shuffled to the rear of the line, where they languished until some of those kits

This old Supertigre .91 hadn't been used in many years, but once it was heated and treated with a penetrating lubricant, it loosened up and runs fine in the new "Tiger 90 Stick" I told you about last month.



This Webra Speed .50, bought back in 1986, has long been a personal favorite of mine, but hasn't been used much since so many new engines were available. My "heat and treat" method of revival worked just fine to loosen it up to run again, but first I have to find a new carb for it. Read the text to learn why.

were dropped from production, therefor becoming inappropriate for review projects. The old ModelTech ARC (Almost Ready to Cover) "Joss Stick", now my "Tiger 90 Stick", that I told you about last month was one such project.

To raise money for subscription refunds, however, I've been forced to sell most of my radios, models, and nicer engines. This prompted me to dig deep into my collection of old and even ancient engines to serve as propulsion units for these revived projects. A neighborhood friend who likes to hang out in my work shop once referred to this treasured collection as, *"Boy, you sure have a lot of old junk in there."*, referring also to my engine cabinet. Upon hearing that ugly word "junk", I was tempted to banish him from my shop for at least a month as punishment. I didn't, of course, since he's not an R/C modeler (yet), so he's in serious need of education and enlightenment that I can provide, at which time he may eventually buy some of my jun... stuff. Besides, we share a common addiction to Red Bull, and he frequently brings several ice cold cans with him to ensure, oddly enough, a warm reception. Even if you prefer beer, you know to appreciate visitors who bring it with them.

Since I had become happily accustomed to a steady influx of shiny new engines for product test reports, the great majority of my old engines have become old without much wear. Despite their only crime being used and dirty, most were sentenced to solitary confinement in small dark boxes for the past 10, 15, and sometimes 20 years and longer. Few (as in "one") had been disassembled and cleaned prior to storage, so the dried remains of the last oil they ever saw had congealed into a substance that more closely resembles epoxy than a lubricant. This, of course, means engines with crankshafts that don't turn, and carburetors with fixed, non-moving throttle barrels. Such engines might make nice paperweights and/or conversation pieces, but they don't belong on a model airplane. (Speaking of paperweights, I considered the old Maloney 100 and 125 gas engines to be so nearly worthless, I once wrote that a Maloney 125 accidently fell from my desk into the trash can, and I didn't think it was worth getting up from my chair to retrieve it!)

At first thought one might be tempted to simply disassemble such engines, clean all the parts individually, and then reassemble the nice shiny parts into a once

Probably my all-time favorite 4C engine is this O.S. FS-91 Surpass. It not only makes great power, it's very reliable and user friendly.

Here's my one and only "famous engine". It's the first K&B Sportster 45 to leave K&B's possession, and it turned out to be a final prototype, having coarse-thread fasteners instead of the fine-thread screws used in the production engines. It also performs far better that the production engines ever did.

again functioning piece of miniature machinery. An admirable plan, no doubt, but let's not rush into anything after giving it only one thought. After counting all the engines that would require such effort, a second thought quickly came to mind that's not only quicker but takes less effort. And let's face it, "fast and easy" has a lot going for it. Just ask any of my high school buddies who knew Sandra Hinkle.

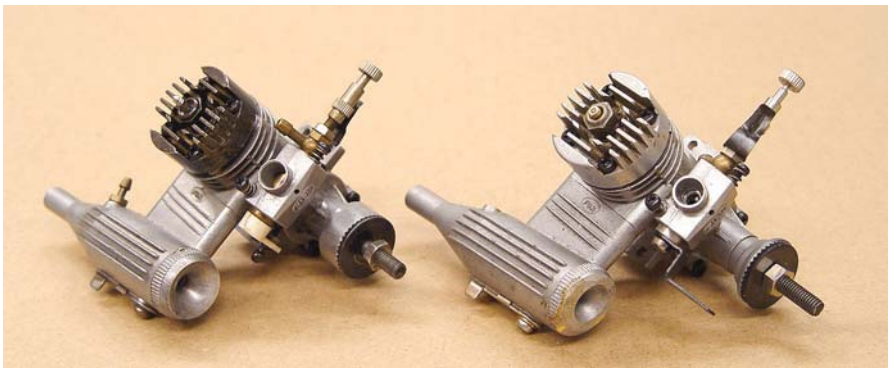
But wait... there's more. A more serious consideration is that nuts, bolts, and screws that haven't been turned in many years are often so reluctant to leave their homes that their shafts break and their heads round off while simply trying to remove them. An engine that might have responded well to "fast and easy" could very well thus join the ranks of my "for spare parts only" collection.

So, as you have surely already guessed, I chose the fast and easy alternative to "long hard work". And now I'm happy to report that it worked pretty well with all but one engine, which I'll cry about as I explain in more detail soon.

My fast and easy road to renewed usefulness for dried-up old engines has very few steps and equally few requirements, and both of have alternatives... other "choices" if you prefer.

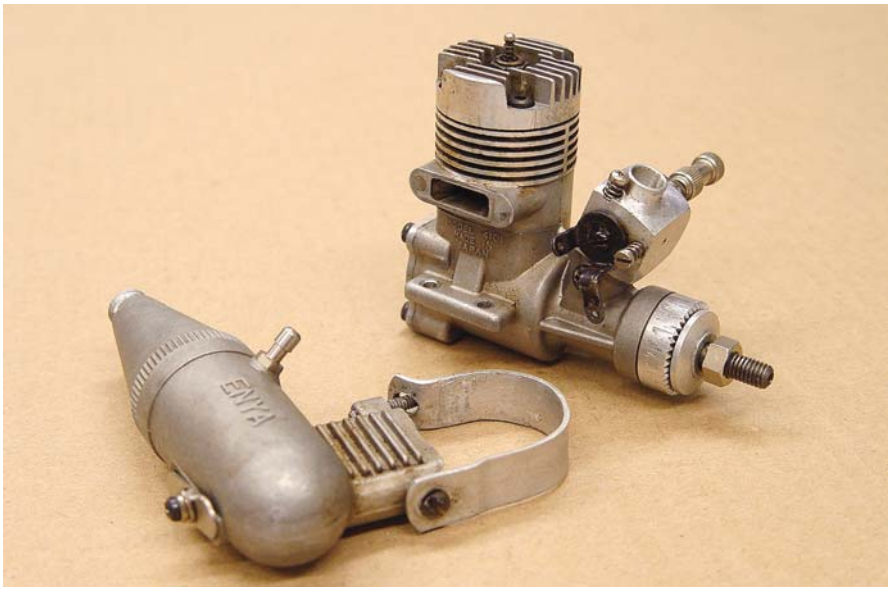
First we need a penetrating lubricant. A spray can of WD-40 is easy to use and does work, but its lubricating qualities are not long lasting. My personal choice is good ol' ATF (Automatic Transmission Fluid), a very common lubricant also widely available in smaller containers marked "after-run oil". Using ATF, however, usually requires a small applicator bottle with a small tip, as is furnished when you buy it as an after-run oil. I use an old squeeze bottle that once contained some kind of lady's hair product, but an old mustard or ketchup squeeze bottle works too. We simply need a way to introduce *drops* of the oil into the engine, not whole ounces. Squeeze a few drops into the carburetor and along the edges of any moving parts so that it will penetrate, and several more drops into the engine cylinder as well. We need to remove the glow plug anyway, so that leaves a nice opening into which the PL (penetrating lubricant) can be introduced.

Now let it sit for at least an hour, but overnight is okay, too. If the engine and carburetor can then be turned by hand with ease, fine. Go ahead and attempt to run the



I somehow wound up with several old and small Fuji engines, like this pair of .099's, even though I was never fond of them. Find out why in the main text.

Another old Fuji engine, this one a .25.



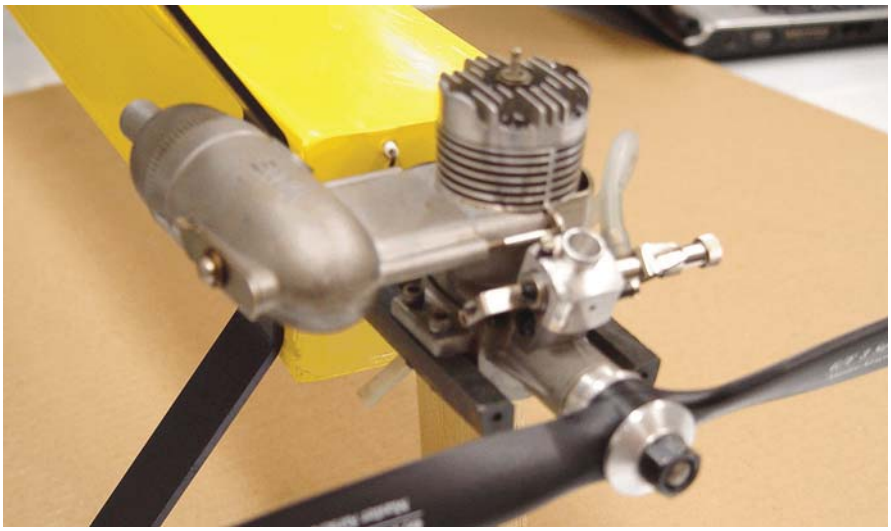
Here's my old Enya .19CXV, an early example of a "dumb" engine. I call it dumb because it seems to think it's a .25. It makes a ton of power for a .19!

engine on a test stand or a test model using an appropriate size propeller for that engine. If the engine is still too tight to turn easily by hand, even with a prop installed, then it's time for step two and requirement number two, heat. I use a covering material heat gun, but a regular old hair dryer can be used as well. Just heat the engine to the point of being too hot to handle with your bare hand, but be mindful of any plastic parts such as rear covers, throttle arms, etc. They can withstand a lot of heat, but give 'em a little consideration anyway, and apply the heat primarily to the engine's aluminum crankcase. Again, heat it until it's too hot to handle with your bare hand, and keep it that hot for a full minute or two to let the heat work its way throughout the engine and its internal parts. We're trying to soften that hardened, gummy oil residue, so the PL can work its way in and perform its magic.

Once the engine has been very hot for a few minutes, using gloves or rags to protect your hands, again attempt to turn the crankshaft and/or throttle barrel. If it still won't turn by hand, then I'll bet it had internal damage and will require the full-disassembly effort.

Using a penetrating lubricant and heat may not be the all-time ultimate best way to loosen an old engine that's been quiet for a very long time, but it sure has worked well for me. I more or less "revived" about 20 old engines this way, and every single one of them responded well. This includes two-stoke and four-stroke, and sizes from My only failure was the Webra Speed 50 bought back in 1986 for our huge .40 size engines shoot-out. I love that engine! It's user-friendly (easy starting, nice idle, etc.) and super powerful for its weight. Anyway, I actually did loosen and dissolve the old gummed up oil residue inside, and freed the crank and throttle to where they turn easily by hand. The failure comes from the fact that I somehow broke off the low speed needle, and no replacement is available (that I know of), so it's a dead engine until I find another carburetor that will work in it.

Why so many little engines when I'm not fond of models designed for engines smaller than a .19? Back in 1986-88 when *"R/C REPORT"* was a young, struggling



Here's another Enya engine that seems to think it's a .25, only thins one is a .29! It runs okay, but falls far short of being impressive. It's the first engine to power this new model, a simple test bed for .19 to .40 size engines.

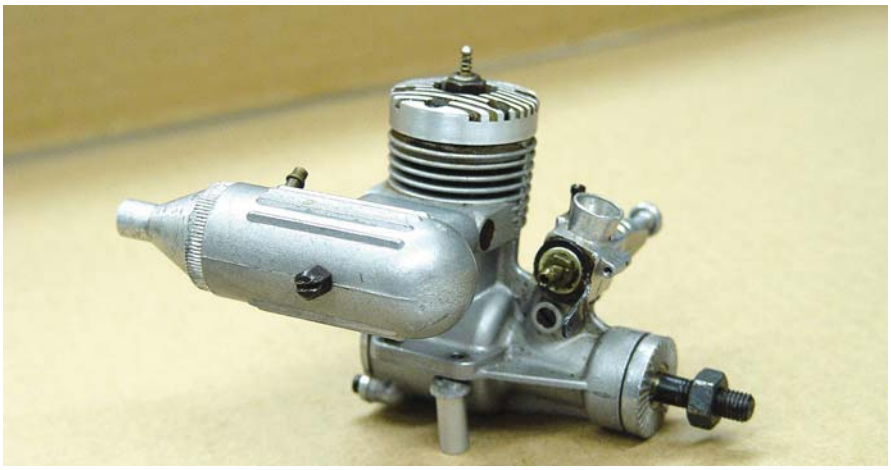
This lightweight little rocket is the Fox .40 Std. Small and light, it also makes great power. We were so impressed we bought and tested a second engine to verify the astonishing results of the first one! When the second engine ran every bit as well as the first, Tim Batt designed a special fun-fly model around this little powerhouse, and called it the Foxbat 40. (Fox and Batt, you see.) This one has a down-swept muffler, but an up-swept version was also available.

business unable to pay me a salary, I had to supplement my personal income with a few, sometimes odd, part-time jobs. That's when I discovered something that proved pretty profitable for about four years before it strangely dried up. It seems that a lot of people who decided to give R/C aeromodeling a try, would get their start-up inventory as Christmas gifts. But after discovering that kit building was a bit more time consuming and complicated than they'd expected, those once longed for kits, engines, and radios eventually found their way into the back of the hall closet where they sat idle with early video games ("Pong", anyone?), old home computers, cast-off hula hoops, and even a few 8-track tape players. I first discovered this by reading a few classified ads in the local newspaper, when some of those disappointed wannabe modelers decided to sell those cast-off goodies to help pay their April 15 taxes. Realizing that even more people just let their stuff sit rather than bother trying to sell it, I began running a few "Wanted" ads for new or like new R/C aeromodeling goods. The response was amazing, and some incredibly good deals resulted. I often bought brand new equipment for less than half its cost, using without even dickering to get a lower price! I'd turn right around and sell these good to modelers who knew their true value, and pocket the difference.

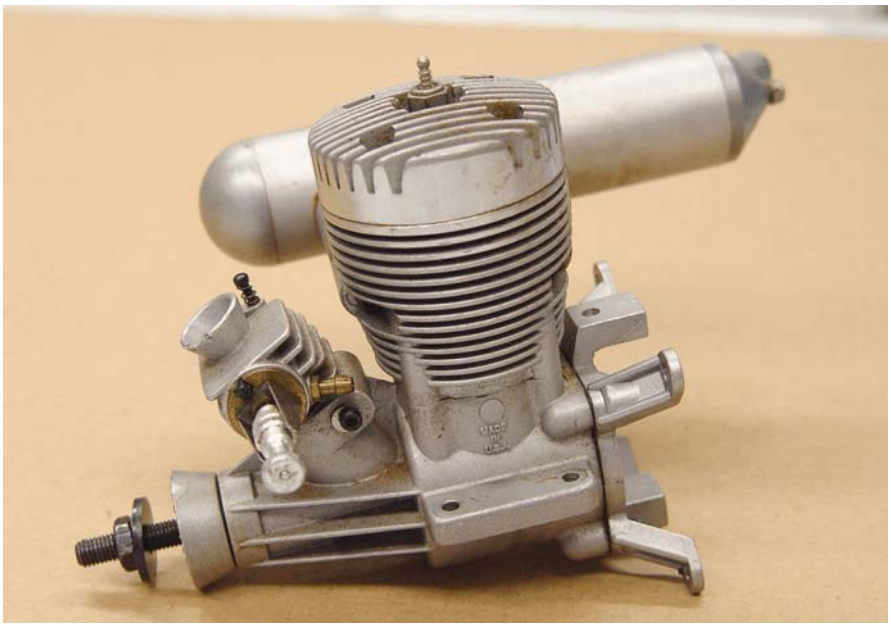
But this also led to calls from experienced modelers who'd been in the hobby for years, yet for one reason or another had or were giving it up. Even though the per item price was usually higher from modelers who knew the true worth of their good, those who wanted to sell their entire inventory were usually willing to take a substantial loss. *"You can have it all for $500."* might yield a nice radio or two, several engines, completed models and unopened kits, tools, accessories, and more. Needless to say, by taking my time and waiting until the right buyer came along, this too proved profitable while still making everyone happy.

Well, one such buy was from a modeler who loved small models, and who apparently had a great fondness for Fuji and Enya engines as well as the ever popular O.S. products. Most of the O.S. engines sold as expected, but the Fuji's and Enya's didn't. Although they all seem to be in good shape, even though some have no mufflers, no one seemed to want them, so I have them still. I don't recall ever running some of them, so several are practically new, except for being really old. Don't laugh at that, you know what I mean.

The Enya .19CXV was one of the first engines I referred to as being "dumb", but only because it seemed to think it was a .25. That is one very powerful engine! The



Why is the K&B Veco .19 so special to me? Because this one is exactly like the one I used to power my very first R/C model, the old original 3-ch Sig Kadet, with which I taught myself (and seven other people) to fly R/C. And just to win a bet, I once used the same engine to fly a 95" span Senior Telemaster!



Here's an engine that I still enjoy flying, even though many modelers don't care for it. The K&B Sportster 65 was another "dumb" engine, too. It apparently thought it was a long stroke (or maybe a 4c) engine, because it runs quiet and swings a surprisingly large prop... just not very fast.

I have no recollection of when or how I acquired these old O.S. .10 and .15's.

bigger Enya .29, however, seemed to have a similar self-opinion, and even though it was user-friendly, it barely out-pulled the old K&B Veco .19!

Oh, now there's a generator of fond memories. Back in 1975 I taught myself to fly R/C using the original 3-ch Sig Kadet propelled by a K&B Veco .19. That little .19 performed so well for me, it led to a very long and satisfying relationship with many different K&B engines, which later grew to include the people at K&B, notably the late John Brodbeck's, both Senior and Junior. Although we had never met, immediately after Huntsville, AL, was devastated by a tornado on November 15, 1989, I received a telephone call from K&B, with both father and son on the line. *"Are you alright? Was your home or business damaged? Do you need any money? Is there anything we can do?"* The tornado missed us by half-a-mile, and we were fine, but I was floored and left speechless by such kindness.

One of my most treasured engines is that one example I alluded to earlier, that had been truly properly prepared for long-term storage. That engine was completely disassembled, thoroughly cleaned, lightly lubricated, and reassembled, not for long-term storage exactly, but for "forever" storage. I do not intend to *ever* run that engine again. It is the one and only "famous" engine that I own! You see, the K&B Sportster 45 that they sent to *"R/C REPORT"* for an engine review turned out to be the one and only final prototype, and the very first Sportster 45 to leave K&B's possession. It boasts two unique features that identify it as being what it is. First, it was assembled with coarse-thread screws, whereas the production-line engines all used fine-thread hardware. Secondly, it's not only quiet

This old K&B Cox .15 was limited to small, speed props, but man oh man did it scream! Its very unusual rear-mount muffler is loud, but it lets the power out!

Why is this O.S. .20FP one of my all-time dirtiest engines? This one was our Engine Test Standard! Read all about it in the main text.

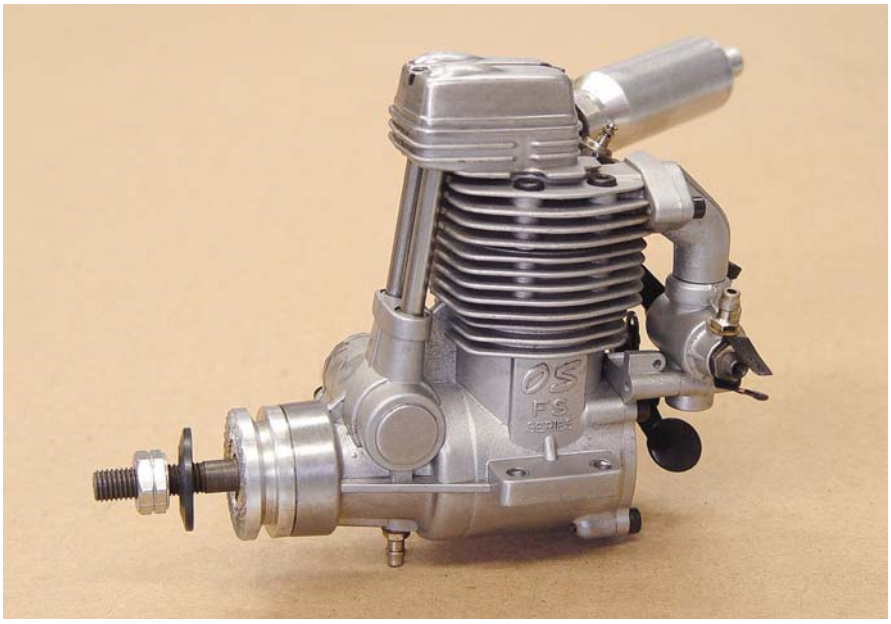
Just one of several old HB engines I own, this little .25 is surprisingly stout!

and has very user-friendly hand ling, it runs like a scalded rabbit! We were so impressed with that engine, we did a follow-up article on it using a tuned pipe, calling it the "Combat" version.

Well, as long-time modelers will recall, the production-line engines were somewhat less satisfying than our test engine. They were, in fact, little more than troublesome, leaky engines that often overheated, seized, and broke their connecting rods. K&B was so puzzled by this, they borrowed back our final prototype engine no fewer than four times, trying to figure out what had happened... where had all the goodness gone? My Sportster 45 performs extremely well in all aspects, while the production-line engines were disappointing in all aspects. And to the best of my knowledge, they never did figure out why.

The Sportster 65, however, proved a different story. Another "dumb engine" because it thinks it's a long stroke, it performs very well with 12", 13", and even 14" props. This quiet torque monster quickly became a favorite of many modelers, and especially with float fliers because the engine contains so few steel parts that rust! I used them on numerous models flown off water for that very reason, as well as being so quiet they didn't bother other boaters. My attempts at quiet running backfired once, though. I used a 14x8 prop on a K&B Sportster 65 powered Sig Kadet Senior, with the idea that the resulting RPM would be so low, it would be almost electric-quiet. Well, that plan worked fine when the Kadet Senior was on floats, but not so well when the floats were hung on the wall while the Kadet used its wheels on a paved runway. With so much less weight and drag, that 14x8" prop kept the light and slow model flying, even when

Here's an engine with a story, a hot K&B Speed .48. Our test engine was a rocket, but was sold to someone who wanted it more than I did. Then a reader bought one and said it was a dud, so he sent it to me saying he no longer wanted it. It didn't run well until I cleaned out the carburetor, but then it ran great. I offered to send it back if he'd pay the postage, but he never answered my letter.



Another fine 4C engine is this O.S. FS-48 Surpass, and I have their FS-26 in an airplane. I actually liked the Saito FA-50 a little better, and at one time I had two of them. But they were both sold along with the models they were in.

the engine was idling slowly! I had to kill the engine before I could get the model to land! It was funny, of course, but it was also a little embarrassing.

As you can see from the photos, my already half-empty can of "Demon-Clean" engine cleaner (see www.bj-model-engines.com) didn't last long enough to clean them all. It's the best engine cleaner I ever saw, but my modeling budget is non-existent right now, so buying more will have to wait. But it will come! I don't like such dirty engines.

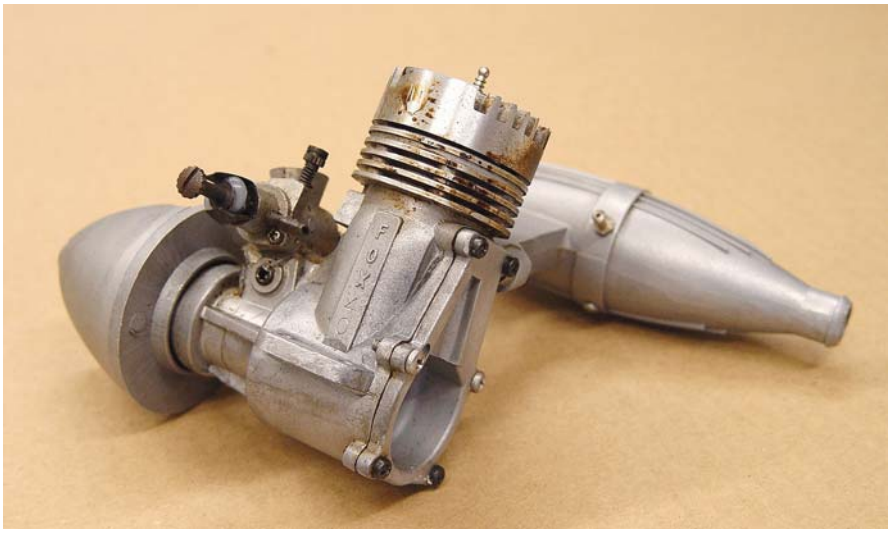
Speaking of dirty engines, note that poor ol' O.S. .20FP. Although its running time is no record setter, the number of times it's been started should be some kind of record. You see, this was the "Engine Standard" that was bolted to our engine test stand for some 20 years, and run every time we tested a new 2C engine. Using its performance on the same day, and using the same fuel, helped us compare the test engine's performance to another engine that was tested on a different day, using a different bottle of fuel. Although run for only a few minutes each time, it was been started and run literally *hundreds* of times. And on a good day, it still turns 13,000 RPM using the same Master Airscrew 8x6 prop!

I've a number of old engines not seen in these photos, too. Many of these engines would go to any buyer making a good offer, but one that wouldn't is the HB .61PDP that currently resides in my Balsa USA Phaeton biplane. Another "dumb" engine, it too thinks it's a long-stroke that can (and does) handle 14" props quite well. Unlike the K&B SPortster 65, however, the HB .61PDP will also turn an 11x7 much like one of those hot, Schnuerle-ported screamers. It's pretty much a do-it-all .61 size 2C engine, and I'm not about to let it go!

Dirty and well used (in numerous models), my all-time favorite 4C engine is the O.S. SF-91 Surpass. It's not only very powerful for its weight, it's also one of the most user-friendly engines I've ever owned. This is another one that will remain with me for many years to come (knock on wood).\

Oh, before I forget, here's something I've learned the hard way about putting engines into storage. Make sure the piston is at the very bottom of its travel to keep the cylinder ports open, and leave the carburetor throttle about one-half open. This way air can pass through the engine to help any trapped fuel evaporate, and it leaves some of the throttle barrel

Many, *many* modelers will recognize this one, the venerable old K&B .40, one of the all-time best selling R/C engines ever made. This one, though, was a later verison with Schnuerle porting, shown with two of the long, tuned mufflers.



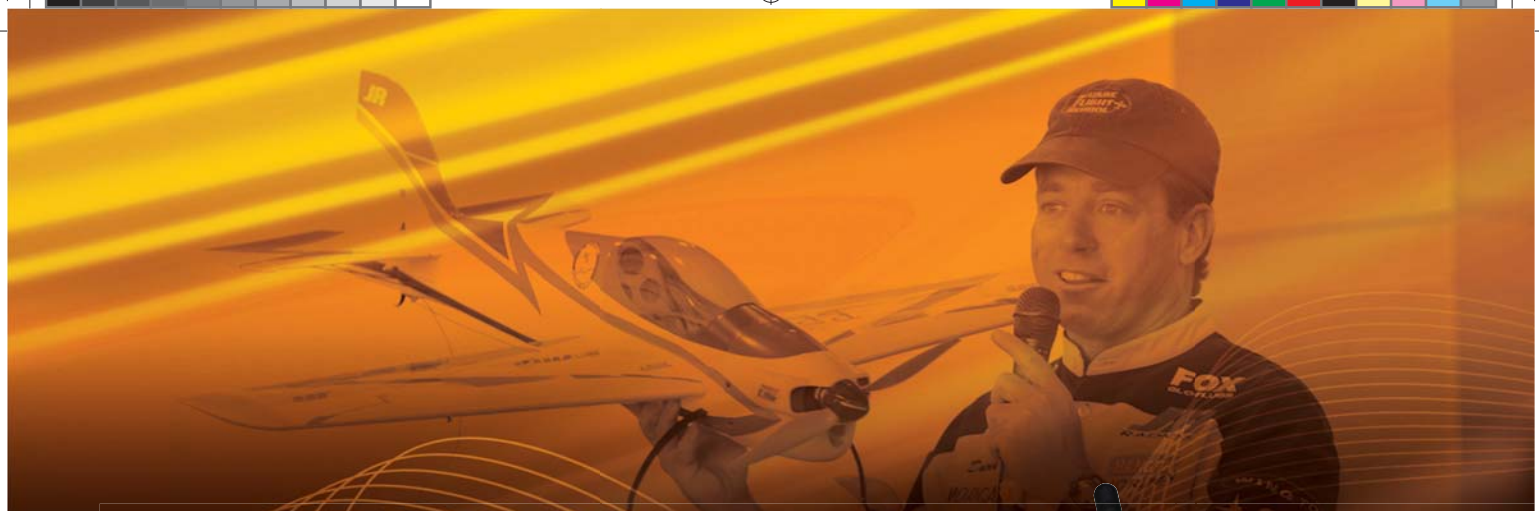
Here's another Fox 40, this one the Deluxe version with a cast aluminum spinner and the up-swept style muffler. It too was a screamer, while the relatively heavy spinner helped reduce vibration and allowed a remarkably reliable low idle.

exposed onto which we can introduce the penetrating lubricant later to help dissolve any dried oil residue in the carburetor. Even better, of course, would be to entirely flush the engine and carb of any and all fuel residue before putting the engine into storage. The only problem with that plan is that we often don't know when we place an engine back in its box, that it will be years before it sees the light of day again. Who knew that many of my old engines would sit idle for 20 years? I sure didn't. In fact, I probably will clean them more thoroughly in the future now that I've seen what happens when you don't.

You may wonder why, with little or no preparation for storage, I've not had an engine go bad from rusty bearings or other internal parts. I sometimes wonder too, but here's what I think has happened. On my last run of the day, I usually pull the fuel line from the carb, and use an electric starter to start the engine again and again until it starts no more, meaning that little or no fuel in left inside. Then with the carburetor wide open, I spin the engine (using an electric starter) for 10-15 seconds to pull lots of fresh air through the engine, which seems to evaporate any remaining alcohol, nitro, or moisture, leaving nothing but a film of oil. This oil may congeal and harden over time, but it doesn't cause rust, and it may even help prevent oxidation by blocking the moisture in the air from the steel parts. I dunno, guys, but I do know that I don't have rust problems with my engines, and Alabama is not exactly famous for having dry air and low humidity.

I think I'll end this now, and go do a little research on the internet. I wonder what Sandra Hinkle is up to these days. No, just kidding. (Besides, she too is over 60 now!)

-Gordon Banks
glbanks@knology.net



ACHIEVING A HIGHER EDUCATION

HELPING THOSE WHO HELP OTHERS LEARN TO FLY

At David Scott's 1st U.S. RC Flight School, hundreds of aspiring RC pilots learn the fundamentals of model flight, from basic takeoff and landing, to advanced aerobatic maneuvers and precise control. In order for David's school to be a success, he needs planes that are in good shape, and more importantly, he and his students need radios that are simple, reliable and can stand up to hours and hours of use.

Spektrum radio systems were the obvious choice, thanks to their 2.4GHz DSM2 technology. And with simple and easy software programing, the students at 1st U.S. RC Flight School can focus on what's important—learning to fly.

The control feel and precision with Spektrum is excellent. Coupled with the piece of mind of knowing that I'm protected from interference, Spektrum technology has increased my effectiveness as both an instructor and a flyer. Honestly, I never realized how much time I spent watching out for control interruptions while flying until all my concerns about radio interference were removed upon switching to Spektrum technology. Bottom line: Flying and teaching have never been more fun!

- David Scott, 1st U.S. RC Flight School, www.rcflightschool.com

Whether you're just starting out like the students at 1st U.S. RC Flight School, or you're a seasoned pro like David Scott, Spektrum systems eliminate radio worries so you can enjoy flying.

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SPEKTRUM®
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THE BIG PICTURE

by Dick Pettit

Like the little girl said in that famous scary movie, "*They're baaaack!"* Yep, I'm back at the keyboard, trying to get back into the swing of things, writing another monthly column for the now *online* version of *"R/C REPORT"*. You should see the dust swirling up from the keys as I type!

First of all I want to thank each and every former subscriber to *"R/C REPORT"*, who sent me kind comments. Sitting here at the computer for several hours every month seems to be a thankless job sometimes. That is, until hundreds of you sent me email and letters thanking me and everyone else involved, for all we've done over the past 20+ years. I hope we can continue to do that and more within the realm of this new format!

Folks, I still want all the photos of giant models that I can get, but now that we're totally digital, we can only accept digital photos, whether taken with a digital camera, or scanned from a print. I personally have no way to convert prints to digital images, but isn't it time you switched to one of the fine, modern image capturing devices anyway? Why remain a slave to film and film processing? Go digital, baby, and you'll never regret it!

You can email the digital photos to me, or you can send them on a CD. For those of you not ready to take the leap into digital photography, there are several stores that can process your film and provide you with a CD of your pictures. Email is a lot faster and a whole lot less expensive. *(Tony's Note: If you send them to me, I can insert them into my photo editor software, make changes where necessary, and then just add them to the text database for the column(s). I use PICASA 3, available free on the internet, and I highly recommend it to the first-time digital photographer. It's very easy to use, and they offer free updates from time to time. Once you get the hang of it, you'll be editing your own digital photos in no time.)*

DIGITAL VIDEO

Since we're now online we can offer videos! If you have a model related video to share with us and the other readers, I'd rather you not send them to me due to email size restraints. I haven't discussed this with Tony yet, but I'm sure he'll let us know something soon. *(Tony's Note: We are looking into this for future editions of RC Report Online, and I'll soon let you know how we plan to handle online videos. Please try to keep the quality high and the length short.)*

CUB WITH WET FEET

Fred Sheplavy, of Eastlake, OH, a suburb of Cleveland, sent me this email and a photo of his 1/4 scale Hangar 9 J-3 Cub on floats, with details on the changes he made to the floats installation.

"Dick, in addition to the water rudder servo, I added a rudder retract servo. To operate the two servos, each float has a receiver and battery. As a result, no ballast was needed in the floats to properly position the CG. The float's rudder servos are mixed to the airplane rudder, but inhibited when the rudder is retracted. The float rudders are retracted just before take-off, and not lowered until after landing. This allows the use of the air rudder without the danger of a water loop during takeoff. I use a 9-ch receiver in the plane, and a 7-ch receivers in each float. The radio equipment is a Spektrumized Multiplex EVO transmitter and Spectrum receivers. The engine is an O.S. FT-160

Photo 1: Fred Sheplavy, of Eastlake, OH, sent this photo of his 1/4 scale Hangar 9 Cub on floats, but he added some interesting features to the floats (see text).

Twin (see **Photo 1**) .

"Today starts my 69th year as a model builder. An aunt gave me a kit for my 7th birthday. This is my 50th year in R/C. I guess I found a hobby I like."

Fred Sheplavy

Thanks for the letter and photo, Fred, and we all wish you another 69 years of model building.

FLEXIBLE FILLER?

I recently had the need to patch up some cuts and slices I'd made in a flexible plastic pilot figure that had been modified to bend it's knees a bit. His legs were stretched out almost straight and he had to bend his knees to get his feet to reach the rudder pedals inside the plane. I made some "V" cuts and glued his legs back together with a few drops of Zap-A-Gap, but there were open wounds in his legs that needed to be "healed".

The pilot figure manufacturer suggested using one of the popular canopy glues, such as Pacer's Canopy Glue. I tried that but found the canopy glue a little too runny to stay where I put it. Then I remembered what I'd used to thicken up epoxy when used as a filler instead of as an adhesive. I'd mixed plain ol' baking soda into the epoxy (or canopy glue in this case) until the mixture took on a peanut butter consistency.

I put some canopy glue in a mixing cup and started to add small amounts of baking soda, stirring until the mixture became a consistency that could be smeared onto the pilot's legs to fill up the surgical wounds, using my fingers to smooth out the bumps and dips. Look, Ma, I'm a plastic surgeon!

I allowed the mix to cure overnight, and when testing the follow-

Photo 2: The roughness remaining after my plastic surgery looks almost like normal wrinkles in the pilot's pants, and right where they're supposed to be!

ing day, I was happy to find the joints still filled, and the parts still pretty flexible. A quick coat of acrylic paint to color his pants just about hid all the minor imperfections. In fact, the few that were left look like wrinkles in the pants, and right where they're supposed to be! **Photo 2** shows what my pilot looks like once I got his legs put back together.

We could also use this filler for a number of other applications, like patching up the inside of cowls, windows, plastic seats, and other places where strength is not important, but flexibility is. Give it a try sometime.

PHOTO FROM AN OLD FRIEND

I received the following email and **Photo 3** from an old friend and fellow magazine writer and photographer, Jerry Smith. No, not the Jerry L. Smith of competition fun--fly fame, the other Jerry Smith.

"Dick, I read your report on the PA Monocoupe. In your review you didn't mention anything about the excessive right thrust in the

Photo 3: Jerry Smith and his PA Monocoupe, with just a wee bit of photo editing.

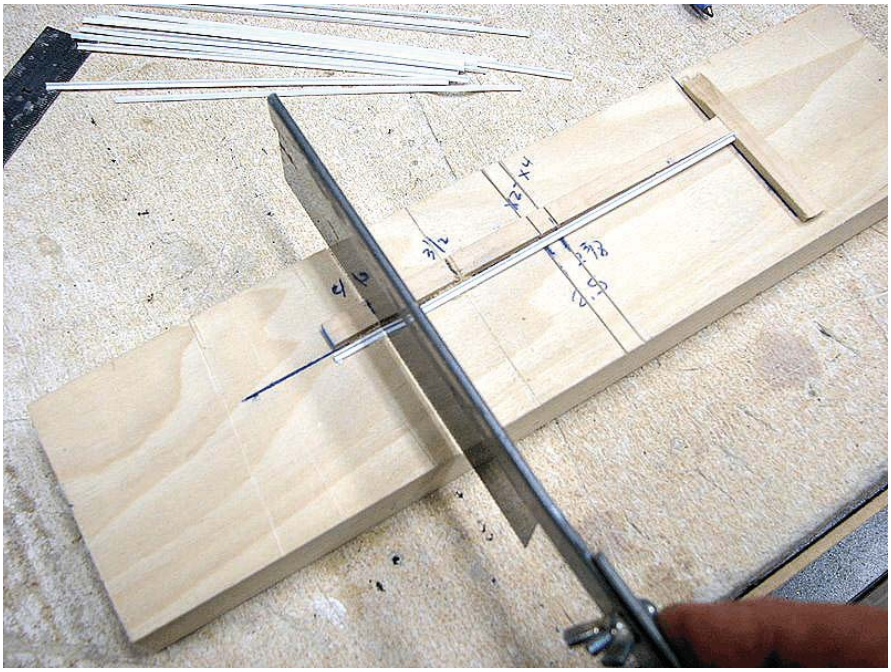

Photo 4 shows the cutting jig I made for cutting the similar size pieces of angle stock to simulate corrugations. See text for details.

model. I had a terrible time with it and ended up taking half of it out. On takeoff I had to hold left rudder instead of right, and the up-lines in the air pulled badly to the right. You are right, though, that it does look a little weird with those short wings.

"I also ran into the same trouble as you did on the outer holes in the wing strut. They were drilled wrong and didn't match. But I had no trouble with the wing joiner. I flew mine with an Evolution 26, probably a little faster than yours. It was certainly a different airplane to fly."

Thanks for your photo and comments, Jerry. There has been a lot of reader interest feedback about this model, so I know your comments will be appreciated.

SCALE DETAILING

I've been working on a scale project for several months now, and once the weather finally cooperated, I had the opportunity to start applying primer to the fully sheeted and fiberglassed fuselage and wings. The corrugations are on both the upper and lower surfaces of the ailerons, flaps, elevators, and both sides of the rudders. They're all about 1/4" tall on the full scale airplane, meaning that the 25% scale size would be 1/16" tall. They were basically inverted "V" shapes that were pressed into the sheet aluminum to provide additional structural rigidity. But, how was I going to simulate these corrugations on my model's control surfaces?

I found that one of the popular plastic structural shape manufacturers, Plastruct, makes a myriad of plastic pieces, one of which is a 1/16" angle stock that can be installed on the control surfaces using Zap-A-Gap. They would all have to be cut to size, which was easy for the ailerons and flaps since every piece would be the same length. Those for the elevators and rudder, however, are nearly all *different* lengths, so each would have to be cut to fit its place. I made the cutting jig seen in **Photo 4** to cut the similar size pieces, and began to mark the surfaces with pencil lines to indicate where each length would be attached. I reduced the number of pieces needed by making the spacing 1" apart rather than the scale 5/8" apart, and I'm glad I did! I ordered 10 packages of the plastic angles, each package containing ten 10"

Photo 5 shows the worthwhile end result of a very time consuming and labor intensive effort.

lengths. That's 1000" (or 83 feet) of plastic angle stock, and I had to order two more packages to finish the job!

Once the corrugations were in place, I applied another light coat of primer to the angles and got ready for painting. As you can see in **Photo 5**, the application technique is very time consuming and labor intensive, but well worth the effort in the completed model.

There are pre-made corrugations available from a popular kit manufacturer, but they come in a solid sheet with a predetermined height and spacing made for one or two specific models. I think the individual angle pieces work well, despite their difficulty to install. Including priming, the entire job took nearly eight hours.

Well, that's all I have for this, the first issue of RC REPORT ONLINE. I hope to be hearing from you in the future, and please send some photos of your latest project so we can share them with our readers. I also want to thank Tony and Julia Coberly for the opportunity to continue contributing to the ongoing efforts and goals of RC REPORT, and Gordon Banks for setting those goals in the first place, and for his continuing work even now to mold our writings into readable columns and reviews. I'm still waiting to see, though, how they are going to make the online version look like it's printed on newsprint paper!

Until next month...

-Dick Pettit
5704 Dedmon Ct.
Durham, NC 27713
pettit@ti.com

FOR THE LOVE OF FLYING

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405 1/3 Scale Nieuport 28-c1*
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408 1/3 Scale Ercoupe (415-D)*
415 1/3 Scale Super Cub*
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461 1/3 Scale Sopwith Pup*
462 1/3 Scale Morane Saulnier A-1*
467 1/3 Scale J-3 Cub*
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411 1/4 Scale Fokker D-VIII*
412 1/4 Scale S.E.5a*
420 1/4 Scale Sopwith Pup*
421 1/4 Scale Fokker DR-1 Triplane*
438 1/4 Scale J-3 Cub*
440 1/4 Scale Nieuport 28-c1*
449 1/4 Scale EAA Bipe*
413 1/6 Scale Nieuport 17
418 1/6 Scale Sopwith Pup
417 Fokker EIII Eindecker 90*
451 Citabria Aerobatic Pro
394 1913 Etrich Taube 90
442 Excaliber ***Re-Release***
443 Smoothie ***Re-Release***
444 Moonraker ***Re-Release***
419 Eindecker 40
434 Stick 40 Plus
436 Bristol M-1
439 Taube 40
448 Phaeton II
450 Phaeton 90
455 North Star
457 Force One
458 Enforcer

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413 1/6 Scale Nieuport 17

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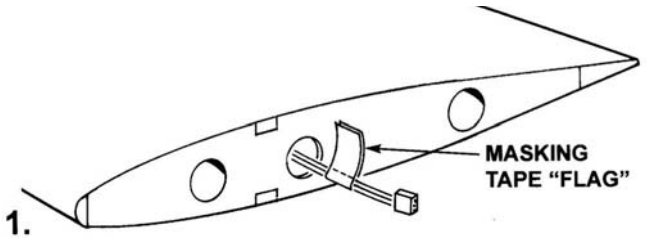
HERE'S HOW...

by Walt Wilson

Share your best ideas and building tips with others. Send your "Here's How…" ideas to… Walt Wilson, 3000 Persimmon Drive, St. Charles, MO 63301, or e-mail them to rallyo@charter.net. Please be sure to include your full name, e-mail, and mailing addresses. The first submitter of an idea used here will receive a free one-year subscription or renewal to RC Report Online. If the subscription is to be a gift to someone else, please state this when submitting the idea.

The end of *"R/C REPORT"* as a print magazine came as a complete surprise to me, long after I'd submitted my March 2009 column. I've always tried to submit my columns at least a month or two before the actual due dates, to avoid last-minute panics and deadline pressures. As a result, I didn't get to tell our readers in that final issue how much I have enjoyed working with Gordon and communicating with all who wrote and sent email to me. I feel that I've made a lot of new friends while doing this column, and I hope to continue those relationships in this new venture. The following contributors have graciously donated their ideas for this first issue of RC REPORT ONLINE. *-Walt Wilson*

(see addresses above)



1.

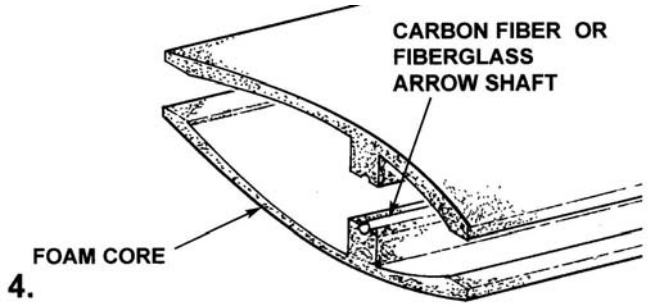
1. From Mark Klein, of New Hyde Park, NY: Mark had a problem with the disconnected servo leads falling back into the wings and forcing him to fish them out at the field. A simple addition of a masking tape "flag" to the leads now prevents them from falling into the wing and the tape may be rolled to fit inside the fuselage when installing the wings and connecting the ailerons.

2. (No illustration) From Larry Wilson, of St. Peters, MO: The next time you install radio gear, use bubble pack to protect your receiver and battery. It frequently comes in packages received and is also available at considerably lower cost per square foot than foam rubber, wherever packaging materials are sold. The

thickness of padding is governed by the size of the bubbles, or number of layers, and the weight is considerably less than foam rubber.

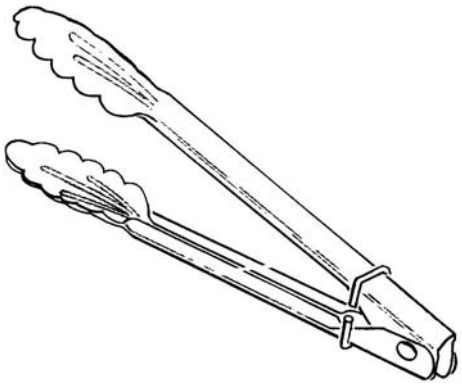
3. (No illustration) From Vince Lindenmayer, of Sheridan, IN: The best safety practice has always been to remove the prop or disconnect the motor wiring for electric aircraft, while working with the radio turned on. That's good advice if one is utilizing the motor battery through the ESC for receiver power, but there is another and easier way to be safe. Don't use the motor battery on the bench! The receiver can still be powered the normal way, by plugging in a regular receiver battery to power the receiver and servos. With the motor battery disconnected, there isn't enough voltage available to run an 11.1 or higher voltage motor, even if the throttle is accidentally moved or reversed. If the receiver is difficult to access, leave a short extension plugged into an unused channel solely for this purpose, and tuck it away somewhere convenient in the fuselage while flying. Since two LiPo cells are close to the same voltage as a receiver pack (4.8 to 6 volts), it may be possible that a 7.4 volt motor could start and run at reduced power with this battery, so this method is not recommended for motors using 7.4 volts or less.

4. From Don Fitch, of St. Charles, MO: Assuming the necessary hot wire setup is available, cut hollow-core foam wings as follows: If the airfoil will be a flat-bottom, make patterns as shown in the illustration. Cut a "W" shaped hollow core and cover the open side with a piece of flat foam. If the wing is to be symmetrical, cut two half-cores and glue them



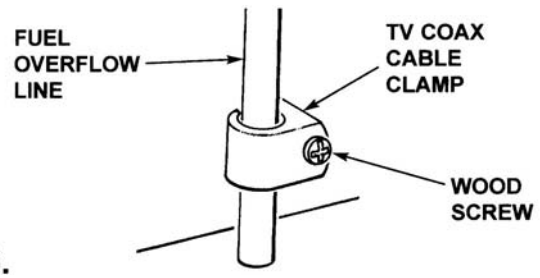
4.

together. The web in the middle is for strength. If additional strength is desired, cut the center web into a "U" and glue in a fiberglass or carbon fiber arrow shaft before assembling the core halves. Add balsa leading and trailing edges. Slot the trailing edge to hold hinges and add ailerons. Flat or shaped wingtips may be added as desired. The core assembly can be sheeted with balsa, or covered with a low-temp iron-on material.


5.

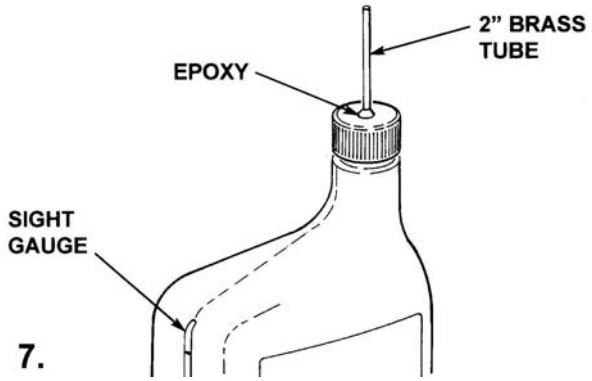
5. Peter Stapleton, of Prior Lake, MN, was repairing a giant scale Corsair and needed to clamp some sheeting in the center of the wing. He didn't have a clamp that would reach in far enough and couldn't find anything that would work at the local home improvement store. Looking through the kitchen drawers, he found his wife's cooking/salad tongs. They have a plastic ring that slides along to collapse them for storage. The tongs will reach almost a foot into the center of the wing. Just slide the ring until it's tight and it will hold a piece of wood in place. (Walt's note: If your tongs don't have a plastic ring, rubber bands will do the job. It may also be desirable to use a protective material between the tongs and wing surface.)

6. From Harry Antenucci, of Albuquerque, New Mexico: Harry usually has the overflow fuel tank line exiting through the bottom of the cowl, and he needed a way to secure it so it would stay facing down and not spill overflow gas into the fuselage or cowl. He uses little coax wire clamps you can get at Radio Shack, or your cable guy may give you some when he installs TV cables. They are just the right size for most fuel



6.

lines. Harry removes the nail that in the clamp by just pushing it out. He then inserts a small wood screw in its place and fastens it to the firewall where the fuel tube is to be anchored. It works great to hold the fuel line without crimping or squashing it.



7.

7. From Bill Lindewirth, of Florissant, MO: For years Bill has been opening, closing, and spilling the one-gallon fuel jugs that he has been dragging to the flying field for his typical two or three flights. Recently, after changing the oil in his car, he had five, 1 quart (32 oz.), plastic bottles left over, so he decided to make some smaller fuel containers. Start by thoroughly draining all the oil from the bottles, and then clean them out with alcohol or even a little fresh glow fuel. Drill the appropriate size hole in one of the caps to snugly fit a piece of 2" long brass tubing. To ensure a leak proof fitting, epoxy the tubing on both sides of the cap. Attach a 12" piece of fuel line to the brass tubing. By using this cap and attaching it to the quart bottle filled with fuel, you can turn the bottle upside down; and by gently squeezing it, fill the tank of your airplane without using any type of fuel pump. After flying, the bottle can be used to drain the tank by holding the bottle right side up and squeezing out the air; then connecting it to the fuel line of the airplane and letting the vacuum inside the bottle draw the remaining fuel out. (Walt's note: I believe you will need a three-line tank, with the third line, used for filling, also venting at the top of the tank. If you fill through the engine fuel line, with the "clunk" submerged, the bottle would suck much of the fuel back out when the pressure is relaxed.)

-Walt Wilson
(see addresses at top)

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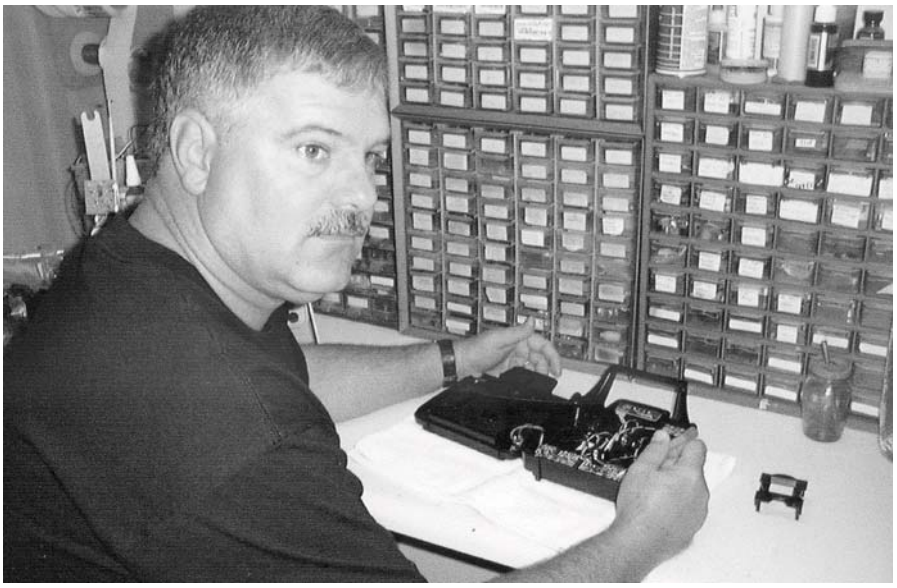
RADIO RAMBLINGS

by Tony Stillman

A NEW BEGINNING?

Back in January we thought we'd written our last columns for *"R/C REPORT"*, but the readers simply refused to accept the loss. There was such a clamor at several R/C websites about not having any worthwhile magazines left, it became abundantly clear that someone had to do something. And now, Tony Coberly has. Due to his hard work with support from Gordon Banks and friends, our favorite magazine has been reborn in an online version! According to Gordon, this online presence may work even better than the printed magazine, since now we avoid the evils of printing companies, mailing services, and the ultimate magazine eater, the infamous U.S. Postal Service.



Personally, I'm very excited to be able to continue working with the old *"R/C REPORT"* group. I've always enjoyed answering reader questions, and helping share what knowledge I have of R/C electronics. Keep in mind that magazine columnists really do want to hear from readers with questions and those seeking help with modeling problems. This helps writers find a direction, and helps readers deal with relevant issues and problems with their modeling endeavors.

For our new readers out there, I want to give you some background on my modeling career. I started modeling at age eight, building plastic models. I began building flying models (mostly rockets) at ten, and then tried control line flying when I was twelve. I built several rubber-power free flight models as well. I got into radio control flying at age fourteen, and continue to enjoy modeling today.

In my junior year of high school I was approached by the manager of a well-known R/C pattern kit manufacturer (Southern R/C Products) to ask me if I'd be interested in working for them. It was something I'd always wanted to do, so of course I jumped at the opportunity. After clearing it with my parents, I started working that very summer. Come fall, I was able to attend school part time and work part time due to a school work program. I had the blessings of my teachers as well, since I had very good grades overall. I continued to work for Southern R/C and later graduated in 1976.

A few years later Southern R/C Products was purchased by Steve Helms, so I went to work for him.

He eventually closed that company, however, but then hired me to help with his new company, Radio South. I began attending Pensacola Junior College to improve my knowledge of electronics so that I cold grow with the company. I took several evening courses in computer sciences, math, and electronics. It was then that I first passed my code and test for the FCC Novice Class License. I continued studying to learn all I could in college, and I was able to use that knowledge in my work for Radio South.

During this time I was also learning many things about operating a small business in the state of Florida. Taxes, paperwork, CPA's, and even lawyers fit into the picture over the next ten years. As my experience grew, so did the business under Steve's leadership, and . Radio South began to flourish and really establish itself in the R/C industry. As I traveled to attend trade shows and contests, I met many great modelers. Some were just regular Joe's, while others were legends in the world of modeling.

Then in the mid 80's, Steve decided to go to work for Futaba Corp. of America, so he sold the business to me. (Steve eventually wound up at Futaba's USA headquarters in Huntsville, AL, not far from Tony and Julia Coberly, and Gordon Banks.) I hoped to use what Steve had taught me to build Radio South even bigger. I had never been a business owner, however, and I knew there would be problems ahead.

Over the last fifteen years I have learned to negotiate financing with banks, deal with lawyers, and even play a role in manufacturing products for sale in the US and around the world. This introduced me to dealing with insurance issues regarding product safety and liability issues.

I think I was one of the very first to consider the problems of model aircraft noise in the competition environment. I was involved in the noise check procedures at the 1983 USA F3A Team Selection Contest, and helped to develop procedures there and later at the 1983 World Championships that would eventually become the standard for how the FAI would conduct noise testing of models at competition events. *"R/C REPORT'S"* early concern with noise issues, in fact, was one thing that immediately drew my interest when it began publishing in 1986.

I have CD'd and co-CD'd many, many modeling events including local contests as well as several USA Team Selection events and World Championships. I was the pattern event director for the NATS in 1992 and 1993, and I have CD'd two World Championships (1983 and 1999). I was the USA Pattern Team Manager for four USA World Championship Teams (1993, 1995, 1997, and 2003). In 2003, by the way, we *won* the Team Championship!

I also served as NSRCA District VP from 1992 to 1993, and NSRCA President from 1994 to 1997, and am currently serving my *third* term as president.

On a local level, I've served in every office of my local club, which I joined in 1971, and I've been an AMA member ever since. I've flown free flight, control line, R/C helicopters, scale, giant scale, pattern, IMAC, sailplanes, R/C assist old timers, and even some pylon racing and combat.

So, with that as my background, you can see that I love modeling very much, and am quite passionate about providing service to modelers. My business is based on trust and top quality work. My goal is to have life-long customers, and we have many!

Now that I'm involved in the AMA as the District 5 VP, I'm still learning, and more than ever! Understanding how technology effects today's modelers, both today and tomorrow, is vital in keeping up with the changing times!

So, enough about me. Now let's get down to some grass-roots modeling issues.

HAVE AN OLD ACE R/C MICROPRO 8000 or KRAFT RADIO SET?

We can now breathe new life into some of these old radios! Why? Well, maybe for nostalgia, or perhaps you want to fly an old model with a radio system that was around when that model was introduced. Or maybe you're in the Vintage R/C Society and simply want to use your old radio gear.

In any event, I have successfully installed modern, Spread Spectrum electronics into old Ace MicroPro and Kraft transmitters. This allows flying the old transmitters with new receivers on the 2.4GHz Spread Spectrum bands. You should be aware by now of the advantages of Spread Spectrum radios in today's modeling environment. Those old transmitters are normally AM units, and while they *can* be narrow-banded and used legally, why not go all out and update it to today's leading edge standards! This is a really good deal if you're flying an old Single Stick transmitter, or maybe you had to get away from single stick because your gear was too old. Well, not anymore! Note the photos of the Ace MicroPro with the Futaba "FASST" transmitter module installed. This will work with the dual-stick or single stick MicroPro. If you have any old radios you'd like to use again... Well, it's something to think about.

If you have a question or need help with a radio equipment question, you can contact me through Radio South. My email and website addresses are at the end of this column for your use if needed. You can also call me at 1-800-962-7802, and if I'm not tied up when you call, I'll do my best to answer any R/C system question you have.

Also, please send any questions you have so that we can work on answers and share them with our readers. Remember, this column depends on your questions and feedback, and whenever you have a question or problem, you can rely on the fact that there are others out there with the same questions and problems. Solving a problem for one reader usually helps many others as well when the questions and results are shared. So, thanks for your loyalty to *"R/C REPORT"*. Had it not been for your undying support, this new online effort from Tony and Julia Coberly may have never happened.

-Tony Stillman
139 Altima Connector, Box 322
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AT-6 TEXAN ARF

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The Texan's forgiving airfoil, operational flaps, and steerable tailwheel all ease your move up to scale warbird flight maneuvers. For more information and the location of the dealer nearest you, visit www.top-flite.com or call 1-800-682-8948 and mention code number 83L.

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Top Flite continues building in quality and realism beyond the point that other manufacturers consider good enough. The included mechanical retracts, for example, offer extra strength for handling even rough landings.

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- **Wing Area: 730 in² (47.1 dm²)**
- **Weight: 8.5-9.5 lb (3855-4310 g)**
- **Wing Loading: 27-30 oz/ft² (82-91 g/dm²)**
- **Length: 51 in (1295 mm)**
- **Requires: 6-channel radio w/8 servos & 2-stroke .61 (10 cc) or 4-stroke .70-.91 (11.5-15 cc) engine**

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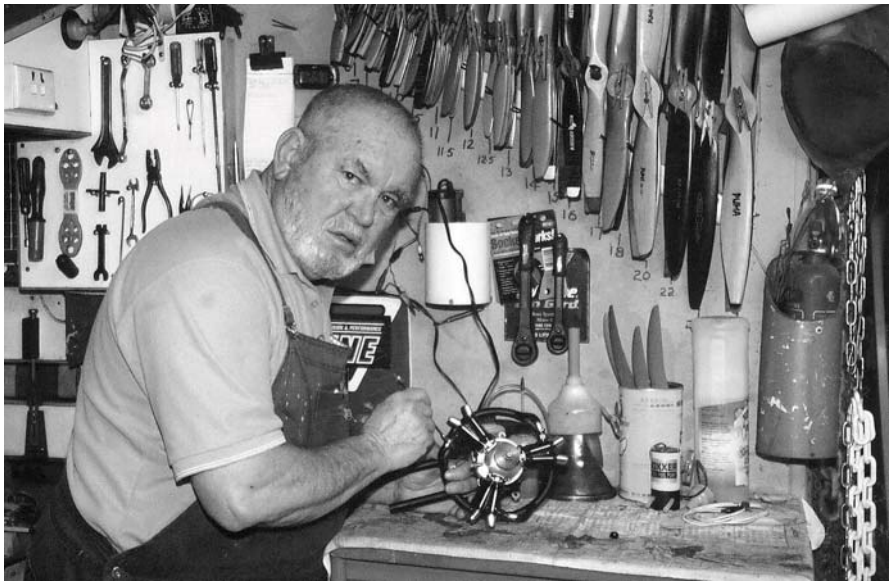
The Oily Hand

by Brian Winch

THE SAITO FG-20

I could have won a lot of money betting that this engine would be produced, had I known anyone who believed otherwise. Saito jumped in to be the first to convert a popular and well established glow engine to spark ignition running on petrol with the introduction of the extremely popular FG 36 model. Very soon after my testing of this engine I had so many inquiries from modelers who were keen to dip their toe in the water - so to speak - that I knew Saito had a winner. I was also prepared to predict that the FG-36 would be the start of something



"I *am* smiling, you worthless sack of wombat wash!"

SAITO FG-20 ENGINE REVIEW

Configuration. . . . . Single cylinder, OHV 4C, with spark ignition, for petrol (gasoline) fuel
Displacement. . . . . 20.52 cc (1.25 c.i.)
Bore/Stroke. . . . 31.7 x 26.0 mm (1.249 x 1.024 in.)
Weight. . . . . 928 grams total (32.73 oz.)
Advertised Power. . . 4.7 kg static thrust (166.2 oz.) using a 16x6 propeller
RPM Range. . . . . 1,800 to 10,000
Recommended Props. . . . . 14x8 to 17x6
Recommended Gas/Oil Mix. 20:1
Propshaft Thread. . . . . M8 x 1.25
Comes With.... . . . . all ignition equipment, a small toolkit with a special plug wrench, instructions, a product sheet, and Saito decals

something... big? a new trend? a new niche already filled? Oh, whatever. It doesn't take a genius to see that petrol fuel is the way to go with large capacity engines. Add to that the ease of starting, reliability, and non-cooling idle of a petrol engine and you have a very desirable source of power for a wide range of model aircraft, with a big accent on scale models.

Now before we move on, a

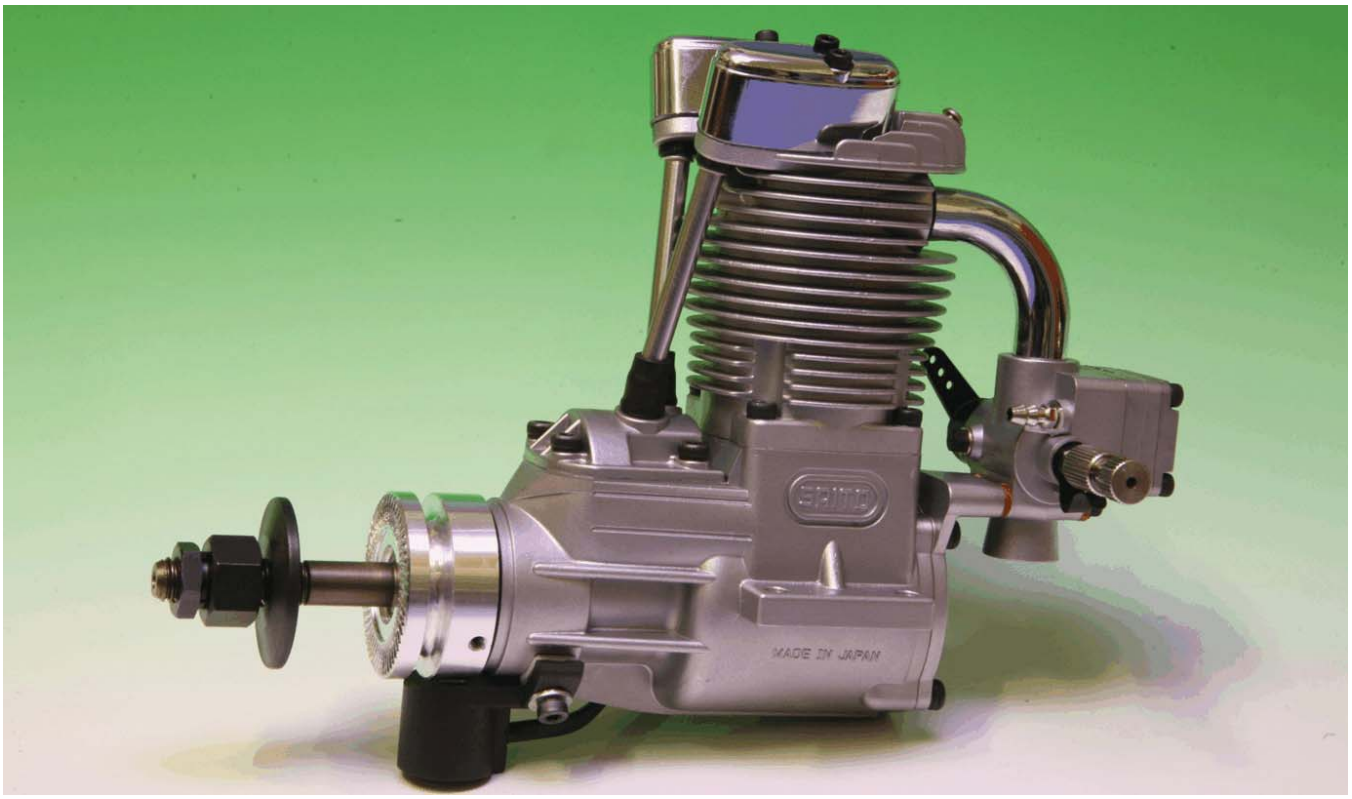


Photo 1 shows the complete Saito FG-20, a 20cc (1.25 c.i.) four-stroke gas engine.

word here about the configuration of this engine: To fully describe the operation, it employs controlled ignition using a spark plug and a capacitor discharge ignition unit (CDI). As for the fuel, ignition engines will run quite well on a methanol fuel, but the carburetor and cooling aspects differ for petrol and alky engines. Running on petrol (gas or gasoline, to you Yanks) also allows using a very small amount of oil in the fuel due to the already somewhat oily characteristic of petrol. Alcohol, on the other hand, is quite "dry", so it requires a higher percentage of lubrication content. Furthermore, due to the ideal combustion mixtures of fuel to air, alcohol is consumed at almost three times the rate of petrol. This is why we commonly see much smaller fuel tanks used in gas-powered models.

Generally speaking, the term "petrol engine" (gas engine) is much more descriptive since petrol requires a constant source of ignition, and a spark plug is the better

Photo 2: The Saito FG-20 crankshaft assembly.

(and most common) choice. Saito, by the way, uses the word "gasoline" rather than "petrol" to suit the US market which is their biggest consumer base.

Basically speaking, the FG-20 is Saito's very popular FA-125 glow engine, but with a few modifications. The FG engine has a lower compression ratio to help

Photo 3: The Saito FG-20 connecting rod.

Photo 4 shows the one-piece cylinder and cylinder head. No head gasket here!

Photo 5: The primary pieces of the Saito FG-20 ignition system.

prevent pre-ignition (aka, knocking). Then there's a small groove in the crankshaft (timing location), a magnet in the propeller drive hub, and two threaded holes in the front housing for the ignition timing sensor. Naturally, the FG has a spark plug which uses the same threads as a glow plug, and the lovely and totally unique Saito carburetor with a built-in pump.

The larger FG-36 uses a modified connecting rod with a bronze sleeve in the big end, but this engine has the normal Saito rod of all aluminum alloy. I don't see this as any concern, however, as the test engine had a load of oil in the crankcase and cam area when I disassembled it. There was also a great deal of oil on my work bench from the engine breather. This "inky black oil" is normal and described (as it should be) in the "run in" section of the instructions. I must say that I still have to remind myself when running this engine, as I did with the FG-36, that oil in the exhaust is almost non-existent, and what you do see is in the form of tiny black splots. This would be a concern with a glow engine, as it would indicate a metal-to-metal problem somewhere, but in a petrol engine this is just as it should be.

All in all, the FG-20 shows the same high quality and top-notch design we see in all Saito engines, along with their special features and manufacturing techniques. The cylinder head is still integral with the cylinder, eliminating the sometimes troublesome head gasket, and saving weight as well (no cylinder head bolts or screws). The now familiar new-style compact exhaust, unique double rocker arm covers, the forged and super tough crankshaft, simple and effective carburetor (with an added section), and the very successful double-nut propeller lock system (with a steel washer). It's still a good old reliable Saito with a few added bits is the way I see it.

Okay, fine, it's well designed and assembled, but how well does it perform? First, instead of acting like a glow engine that kick back during starting unless everything is just right, a modern day ignition engine is very well behaved. It starts with slightly retarded ignition timing, and the CDI unit has sophisticated circuitry that reads the magnetic pulses and varies the ignition timing according to the engine load and speed. There is *very* little chance of a kickback due to this timing control. If you flood a glow engine you're *asking* for a good kickback (unless the plug is totally drowned), but with sophisticated variable ignition timing, even that is eliminated.

Photo 6 shows the intake side of the Saito FG-20 carburetor.

Photo 7: The normally hidden side of the Saito FG-20 carburetor. Note the heat insulators around the mounting screws, to help keep the carb cool.

Having said all that, I still urge you to use a proper electric starter for safety reasons. There's nothing "macho" about hand-starting any model airplane engine, and there's really no valid reason to insert your hand into the area where a spinning propeller will quickly teach you not to do that again.

The Saito FG-20 is a very easy engine to start (yes, even by hand). Petrol vaporizes more rapidly than methanol, quickly filling the combustion chamber with ignitable vapors, and the healthy, timed spark is a sure path to easy starting. Add to this the lower compression, and you don't really even notice that you're starting a 20cc engine.

And before I forget, I noticed very little vibration from this engine, most likely due to the ignition control and the lower compression. Also, I strongly advise you to read and follow closely the run-in instructions, and use a tachometer while doing so. When tuning the carburetor, the engine hunts when rich but then runs smooth and evenly at the correct mixture, but it also sounds much the same when tune a bit lean, and this is the danger point if you venture into these muddy waters. I watched the tach and a heat sensor while I was tuning for full power, and I saw the RPM remain steady, with no further increase as I continued to lean the fuel mix, but the heat sensor sure kept climbing! Four or five clicks richer maintained the same peak RPM, and the temperature rapidly dropped to a safe level.

The FG-20 performed flawlessly during the run-in and propeller tests, and I used only about one liter of fuel for close to two hours of running time. At the end of the test, apart from a small lake of oil

Photo 8: The Saito FG-20 has a beautiful cast aluminum crankcase. (Editor's Note: Brian particularly likes crankcases because he's an old crank!)

Photo 9 shows the Saito FG-20 muffler.

on the test bench (from the breather), the engine was as clean as it was right from the box, except for a normal sooty interior in the muffler.

Here are some more interesting points, and a note of caution:

The carburetor's built-in fuel pump is very efficient, pulling fuel from an upright fuel can about 300 mm (11.8") away from the engine. Transition was immediate, and the fuel did not drain back to the tank during shut-off periods. I carried out the run-in and testing over two days, and on the first day, as I was closing the shop, I noticed a bubble in the fuel line from the can to the carb, so I marked the fuel line at each end of the bubble. When I came back about 18 hours later, that bubble had not moved! This indicates very efficient valves in the fuel pump!

Now here's a caution about the ignition: Double check that the ignition is switched off or the battery disconnected when working on the engine (prop changes, etc.). On more than one occasion I heard a distinct "woof" inside the engine when I switched the ignition on. The magnetic sensor must have been right at the starting position, and the piston very near Top Dead Center (TDC). A small amount of petrol vapor must have been lingering in the combustion chamber, ignited when the spark plug arc when I switched on the power. I make it a habit to close the throttle when I'm changing props, etc., as a safety measure, but with a slightly open throttle and the piston near TDC, there's better than a good chance the prop could kick or the engine actually start when you turn on the power switch. So be wary and careful.

Testing was done on Feb 14, 2009, with the temperature at 19° C (66° F) and the humidity at 90% (cool and damp). I really enjoyed

running this engine, and I look forward to seeing it perform nicely in a model airplane. Before we get to its actual performance, though, let's look closer at its parts for those of us interested in such.

CRANKCASE (Photo 8)

The lower housing has a very smooth casting with a satin finish. The mounting beams are 43.2 mm apart, with 4.2 mm holes spaced on 25 mm centers, and small gussets on top for added strength and rigidity. The front housing contains the two crankshaft bearings, an open ball bearing in the rear, and a fully sealed bearing up front. This section also incorporates the camshaft housing with provision for the cam assembly plate to be mounted with four screws allowing the cam gear to mesh with the cam pinion on the crankshaft. The top section is the base for the cylinder which fits neatly down into the crankcase and is secured with four screws. The rear cover is oriented by the bracket for the carburetor, and is fitted with one nipple and one blank pad (maybe smoke pressure, if needed). Added parts are the bright red and gold logo "FG-20" badge on one side of the main crankcase, and the two tapped holes in the lower section of the front bearing housing for the magnetic ignition timing sensor. Two shaped plates are fitted under the sensor to provide the necessary clearance over the propeller drive hub in which the magnet is fitted.

Photo 10: This is the same piston as used in the glow version, but note the like-new appearance of the ring, even after approximately two hours of running!

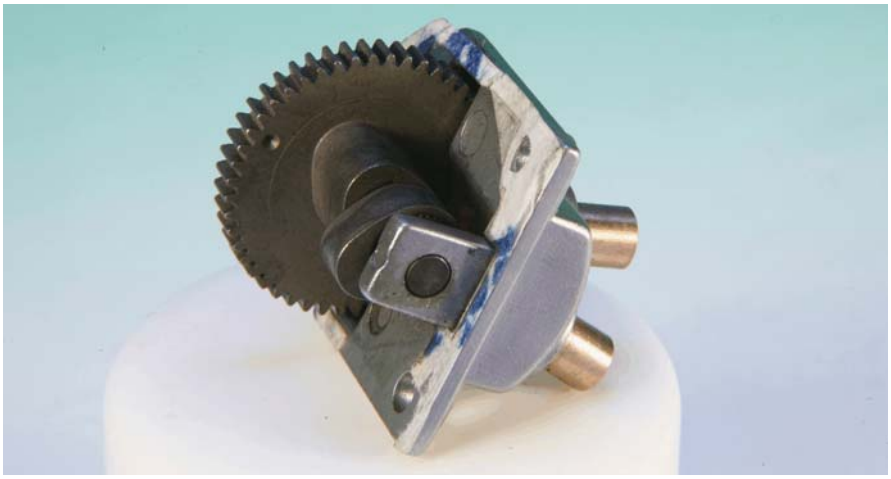


Photo 11: Sintered metal cam and cam gear assembly. The visible dot on the side of the gear is the timing reference.

CYLINDER (Photo 4)

Other than a dimension change (for the lower compression), the cylinder is completely standard. The one-piece unit incorporates the head and cylinder, which is internally hard chrome plated to serve as the integral cylinder liner, a well proven system used by Saito for many years. As with all the newer design engines, the cooling fins have been modified to allow easier access to the cylinder base screws (a welcome change!), and standard Allen wrenches can now be used if you don't have access to a power driver. The combustion chamber is a figure-8 shape offset to one side for the spark plug. The valves enter at an angle and form what's known as a "pent roof chamber". Its external finish is the same satin finish as the crankcase, and the casting is of very high quality.

As already stated, the liner is integral with the cylinder so we have only the piston to consider in that section. Cast in a permanent mold, the piston material is a high silicon content aluminum alloy with excellent wear qualities and a very well controlled amount of expansion even under very hot conditions. Couple this with the aluminum cylinder and it's easy to see why a seized piston in a Saito engine is a rarity... practically unheard of (none have *ever* come across my bench). As you can see in the photos, the piston ring shows no sign of wear whatsoever, even after all the running time I accumulated on the engine. This really surprised me when I cleaned the parts for close inspection. It's rather obvious that the lubrication is more than ample, and that there should be a slight increase in performance after a few *more* liters of fuel are consumed.

The connecting rod (aka, conrod) (see Photo 3) is the usual forged aluminum alloy, tough as old nails and no need for a bearing insert (as found in the larger FG-36). Instead of the hole or two usually found in the big end eye, this conrod has a 1 mm slot in the base of the circle that covers 1/3 of the eye diameter. The little end has one hole drilled at the top of the circle.

The crankshaft is forged (yes, *forged!)* from high tensile alloy steel, very finely machined on non-contact surfaces, and *extremely* finely finished on the journals where the ball bearings are fitted. In the secondary journal after the integral gear drive pinion (small gear) just in front of the front bearing location there is a short, shallow slot. This is the locator for the propeller drive hub to ensure correct ignition timing is maintained if the hub is removed and replaced. The hub locks in place with the common split-tapered collet, but in this case the slit in the collet has been widened to allow for a plain end (no thread) of a setscrew to go through the collet slot and locate in the crankshaft slot. This pin (setscrew) is only the locator, however. The tapered collet is still the primary means of locking the hub in place, and with Saito hubs and collets, there is no slip. To prove this, try removing one even with an industrial type puller. Hint: Bring plenty of muscle with you. The prop washer is tapered steel (ideal) and the propeller nut is a two-piece locking assembly to prevent free flighting props. All in all, the crankshaft is a thing of beauty.

The camshaft is the long time standard assembly of having the cam gear with one cam keyed to the other, and all in rock hard sintered steel. Inside the assembly is a fixed bronze tube bearing that spins on the captive camshaft. Above the shaft, in the bronze guides pressed into the cam case cover, are the hardened steel cam followers. Only a *very* severe crash would require a new cam assembly, but you'll never *wear* it out!

CARBURETOR (Photos 6 & 7)

Here we have the standard Saito carburetor principle grafted onto a small box housing the fuel pump and regulator. The carburetor section is as on all Saito engines, and the main needle, idle needle, and throttle arm are all standard. It's the pump system, as it's labeled, that is of prime interest here. There's no doubt that this has been specifically designed by Saito for their engines. Inside the pump system are 11 separate parts: diaphragms, valves, restrictors, and regulators, all in a neat little assembly that works very well, and every part is replaceable. As with the FG-36, the carburetor is isolated from the engine's heat by insulating inserts for the mounting screws. As I said, petrol engines run a bit hotter and petrol is subject to high evaporation. In engine terms this is known as a vapor lock, when the petrol vapor prevents liquid petrol from passing through the carb, much like a cowl on a model preventing fresh air coming in if the outlet is too small. In use, the pump system worked extremely well, and as mentioned earlier, has excellent return valve sealing. All in all a very nice little unit that I'm sure we'll see on future Saito engines as well.

EXHAUST (Photo 9)

The latest style compact muffler is supplied with the engine. It's cast aluminum alloy with a thick wall that goes a long way toward deadening the sound and ringing noise commonly heard from thin-walled aluminum tube mufflers.

The main body is in two parts, sealed well and held securely with a cap head screw is accessed in the baffle section outlet. The header has a slight curve and this, coupled with the positioning potential of the muffler, allows for almost any outlet position to suit your application. No muffler pressure nipple is needed with this engine, due to the built-in fuel pump and regulator in the carburetor.

IGNITION (Photo 5)

The Saito CDI unit provides totally automatic variable ignition timing according to the speed and load of the engine. The case is chromed plastic with an aluminum sheet base, and this outer metal surface provides the Faraday shield that keeps all electrical spikes and pulses where they belong, inside the case. The sensor is the magnetic inductance type using a magnet in the prop hub and a metal rod in the pickup. The high tension cable is shielded with an external mesh grounded with a cable and terminal for attaching to a mounting bolt on the engine. The connection to the special 1/4 x 32 thread plug (same thread as a glow plug) is with a push on stainless steel cap with a locking spring clip that locates in a groove in the body of the plug. The clip ends are pressed together to remove the cap, so it otherwise stays in place. The CDI will operate on 4.5 to 6 volts, and draws approximately a frugal current requirement suitably matched by the engine's fuel consumption of around 10cc per minute at peak RPM (approx. 9,000). This is all in all a very nice and reliable system.

MEASURED PERFORMANCE USING APC PROPELLERS

Prop Size	Peak RPM	Min. Idle
14x8	9,535	2,100
15 x 6	9,836	1,920
15 x 8	9,127	N/A
16 x 4	9,481	N/A
16 x 6	8,610	1,564
17 x 6	8,201	1,347*

(*great for scale models)

SUMMARY

Frankly, I consider the Saito FG-20 to be a fine and very interesting engine with many applications, and a particularly excellent choice for scale models. The promising reliability and frugal fuel requirement also make them an ideal choice for a multi-engine model, from which the multi-engine sound would be magnificent!

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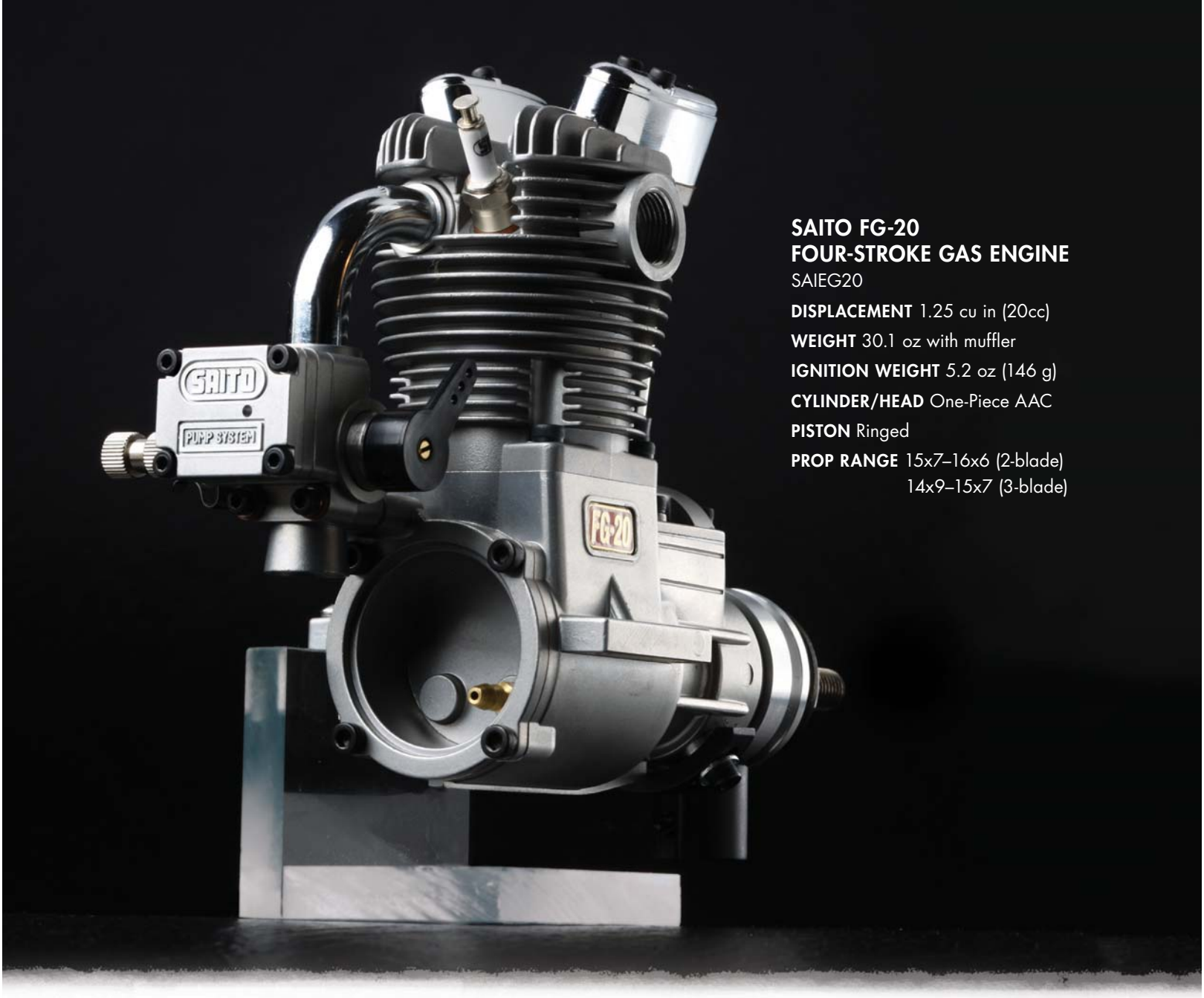

SAITO FG-20
FOUR-STROKE GAS ENGINE
SAIEG20

DISPLACEMENT 1.25 cu in (20cc)
WEIGHT 30.1 oz with muffler
IGNITION WEIGHT 5.2 oz (146 g)
CYLINDER/HEAD One-Piece AAC
PISTON Ringed
PROP RANGE 15x7–16x6 (2-blade)
14x9–15x7 (3-blade)

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Perhaps the most amazing detail about this unique powerhouse is the first purpose-designed gasoline carburetor for model engines. Lighter and smaller than other industrial carb designs, it operates with the same ease you have come to expect and its size allows the engine to be conveniently dropped into most airframes.

The impeccable workmanship of the FG-20 results in tremendous operation that can decrease your operating costs by up to 90%*. It also has enough power to swing a 15" x 7" three-bladed prop.

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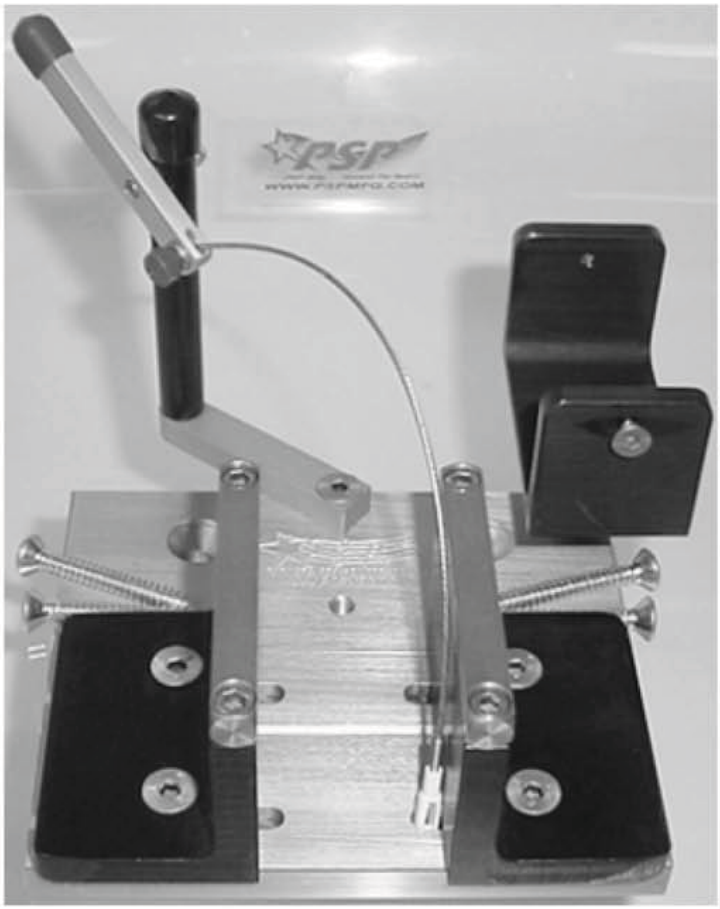

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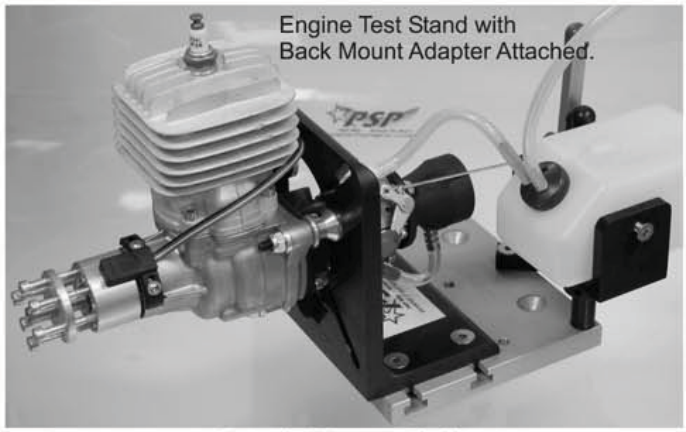

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Bird on a Wire

by Terry Dunn

Hi again everybody. Without getting into any mushy, sentimental stuff, I'll just say it's good to be back. These last few months have been interesting for me. On the same day that I turned in my last column to Gordon, my mom and dad were involved in a serious motorcycle wreck near their home in Florida. I've made two trips out there to be with them and help them out. The good news is that they are both recuperating well and the doctors expect them to recover fully. *(Good news! We will pray for continued healing! Julia)*

My first trip to Florida was just before Christmas. My wife and kids stayed in Texas, so I had plenty of time between trips to the hospital to tinker around. I found a couple of old R/C derelicts in my dad's garage that proved useful for keeping me busy. One of them was an Ikarus Bleriot slow flyer. If you're not familiar with the Bleriot, it's very similar to the fabulously popular GWS Slow Stick. The semi-scale Bleriot came first, though. I wouldn't say that GWS copied the Ikarus design, because the Slow Stick incorporates several features that make it a more rugged and user-friendly airplane. However, the novel Bleriot certainly may have inspired the GWS designers.

Photo1: The ORB (see text) is a homemade flying wing adapted from the surviving parts of an abused Ikarus Bleriot foam slow flyer. Note that it uses rudder/elevator controls instead of elevons, which are standard on flying wings. Small electrics are ideal for this sort of tinkering. (Lewis Dunn photo)

This particular Bleriot had seen better days. The quasi-scale features such as the foam gondola and wooden wheel struts had long been abandoned after several repairs. Much worse was that the airplane had been supporting a spare set of Harley Davidson exhaust pipes on my dad's parts shelf. This creased the aluminum square-tube fuselage and obliterated the tail feathers. What I had left was a set of large, slightly warped foam wings, half a fuselage, and some foam scraps. The power system and 3-channel radio with two servos still seemed to work fine. I quickly decided that this mess of parts would rise from the ashes as a flying wing!

I have a fair amount of experience building, flying, and modifying flying wings, so I was confident that I could make this one work. It turned out to be a little more challenging than I expected, but the mental exercise was as welcome as the physical busywork that the project created. I do love a challenge!

My first task was to stop by the local hobby shop for some sheet foam and music wire to make control surfaces and pushrods. After a few hours work, I was ready to do some glide testing. These tests confirmed that my predicted balance point was pretty good, but they also uncovered a surprising control problem. As usual with flying wings, I used elevons for control. Elevons are basically aileron-type surfaces on the trailing edge of the wing that provide both pitch and roll control. During my glides, pitch authority was great, but I was getting severe adverse yaw each time I tried to turn. To be specific, when I gave control input to roll right, the airplane would yaw to the left. Surprise! I'd experienced adverse yaw before, but never to the point of complete control reversal!

Ignoring the severity of the problem, I attacked this adverse yaw the same way I would on a normal airplane, by incorporating differential throw. I adjusted the servo horns so that I would get more "up" throw than "down". Further glides, however, revealed that I still couldn't consistently turn in the direction I wanted. In-

termittent steering is not a good feature! *(This is also true outside of the world of R/C aircraft! -Julia)*

I took a step back to observe my dilemma and the solution smacked me in right the face. *(Editor's Note: I'd be willing to do that even without the solution.)* Since the wing mounts retained the stock dihedral angle, I could use rudder and elevator controls instead of elevons. I made the appropriate changes and the new control system worked perfectly.

Flying the revamped Bleriot is a unique experience. It will fly incredibly slowly, of course, but it doesn't tolerate much wind. The wings are considerably thinner than those of a Slow Stick, so they are prone to flutter if I try to do something as crazy as racing butterfly! *(Did you win? -Julia)* The large control surfaces are perfect for super-slow puttering, but add more throttle and they become quite sensitive. It will do a loop seemingly in its own stubby length. One of the wings has a visible warp, but once the airplane is trimmed out, it doesn't seem to matter much. This is one of those planes that's easy to fly, but difficult to fly well. In the end, it was a rewarding little project.

The one lingering task is to find a new name for this airworthy concoction. The best I've come up with so far is "ORB" (Overhauled Redesigned Bleriot). It's a rather uninspired name, but it's the best I've got for now. So I'll keep it until a better idea comes along. *(Editor's Note: I keep thinking about how well that last smack in the face worked.)*

I realize that my story of the Bleriot does not discuss electric power systems, but it does drive home one often overlooked aspect of electrics. These little foam park flyers are just so easy to build and modify. Whether building from a kit or scratch building your own design, the absence of a wet-fuel motor relaxes many of the traditional constraints of R/C design and construction. With just a little foam, tape, and glue, you can explore the outer fringes of your aerodynamic comfort zone on a shoestring budget. Uneven cuts, a bad paint job... that stuff hardly matters here. When working with minimalist airplanes such as the Bleriot, you're forced to concentrate on the things that really count, like structural integrity and aerodynamics. Of course, the lessons

learned carry over into our larger, more expensive planes as well.

The Deland Municipal Airport (Sydney Taylor Field) is about a 15-minute drive from my parents' home. Anyone into skydiving may recognize Deland as a Mecca for the sport. In addition to the skydiving and general aviation that takes place there, it's also home to the Deland R/C Golden Hawks. I made several trips out there in an effort to take up more of my idle time and divert my mind from the more serious matters. Two of the local fliers, Andy Bowen and Charlie Sampsell, went out of their way to make me feel welcome. They let this total stranger fly their airplanes, invited me back repeatedly, and even offered me a ride to the airport when it was time to go back to Texas. I met many other Golden Hawks members during my stay, too. Thank you all for your hospitality, and a special thanks to Andy and Charlie. *(Editor's Note: Boy were you lucky. Every time I visit another club's flying site, everything seems normal until I identify myself. But then they suddenly remember they have to cancel any further flying so they can do maintenance, like replacing the runway bearings, tighten the flight line, or re-calibrate the wind sock.)*

Photo 2: My MiniCraft Simpli-Fly 40 tow plane waits patiently at the edge of the runway as Lee Ray readies himself to fly his Multiplex Easy Glider. (George Harrington photo)

Photo 3: The Easy Glider rises into the overcast while the Simpli-Fly 40 builds flying speed. Minor changes will be made to the Simpli-Fly in an attempt at reducing the climb speed when towing. (George Harrington photo)

Once I was back home in Houston, I focused my R/C efforts on the glider-tug discussed in my previous column, the MiniCraft Simpli-Fly 40. I met my aero-towing partner, Lee Ray, at Scobee Field on the west side of Houston. To start things off, I "re-maidened" the Simpli-Fly. The plane had obviously seen countless flights under previous owners, but this was the first under my control and quite likely the first one using electric power. After about three minutes of feeling it out, I was convinced that everything was working well, so I landed and got the plane ready for its first tow.

At the other end of the tow line was Lee's Multiplex "Easy Glider". I placed the Simpli-Fly at the edge of the paved runway with the Easy Glider nestled in the neighboring smooth grass (see **Photo 2**). Once I got the nod from Lee, I eased in the power for takeoff. The Simpli-Fly was still rolling along the runway as the tag-along Easy Glider gracefully broke ground (see **Photo 3**). Soon both planes were airborne in a gradual climb at a little over half-throttle. After a few circuits of the field, we decided that the Simpli-Fly likes to fly a little faster than we liked with the Easy Glider. Whenever I backed off the throttle to find a comfortable speed for the glider, it looked like the climb rate of the tethered pair slowed to a crawl. So,

Photo 4: After one of our tow releases, Lee and I raced back to the ground…it was a photo finish…literally. Here, the Simpli-Fly lands on the runway while the Easy Glider in the background picks out a soft patch of grass.
(George Harrington photo)

we defaulted to the faster speed for the rest of the day.

I think this problem can be corrected with simple trim adjustments. The stock Simpli-Fly motor mount has significant down-thrust, which I retained when I added the mount for my electric motor. For my next aero-tow outing, I'll add a few washers to reduce the down thrust. That should help narrow the comfortable speed gap during aero--tow.

You may recall that I'm using a 6S (6-cells in series) 2300 mah Lithium-Nanophosphate (A123) battery in the Simpli-Fly. We found that this battery is good for two tow flights with a little left in reserve. Frankly, I was hoping to get three or four tows from each charge. My hunch is that my solution to the speed problem may also give a little relief here as well. My true goal is to be more efficient during an aero-tow climb, using the same climb rate while using less speed and power. If that goal is realized, then I may get three or more tows per charge. I don't expect any huge gains, but another minute or two of duration will help.

To make more significant gains in duration, I'll tinker with the power system a little. The easy path would be to replace the battery with a higher capacity LiPo of equivalent weight and voltage, something like a 5S 3300 mah battery, which would provide approximately 45% more duration. The problem with this idea is that I don't have such a battery, and they're expensive. However, I do have a couple of 4S 3300's that I think may work.

I also want to maintain my 100 watts/lb. power loading for this airplane. So, the goal for this tweak will be to maintain the same level of power output from the power system with the lower voltage 4S battery. Remembering that power equals battery voltage multiplied by the current (volts x amps = watts). *(Was that covered in math or science class, Terry? It's been so long, I can't remember! -Julia)* So if we reduce the voltage, we must increase the current to maintain the same power level. To increase the current, we increase the load on the motor with a larger prop. The original power system used the 22.2 volt 6S A123 battery with a 10x7 prop to produce 615 watts of power at about 35 Amps of current (the voltage sags to about 18 volts under load). Using the same Welgard GH3520-12 motor, but now with the 14.8 volt 4S Lipo battery, I switched to a 12x6 prop to produce 575 watts of power at about 42 Amps (more saggy voltage is normal and expected).

There are several factors at play here that will determine what, if any, performance difference I'll see from these tweaks. First of all,

Photo 5: I was able to attend one day of the Deland Florida Golden Hawks RC Club's inaugural Electric Fun Fly. There was a broad range of impressive electric aircraft present including this large Bell 47.

by going from a 10" to a 12" prop, I gained about 50% more prop disk area (the area of the circle scribed by the spinning prop). That change will increase the overall efficiency of the power system. On the flip side, the motor may operate *less* efficiently because it's now pulling 42 Amps at full throttle instead of 35. Another factor is that the airplane shed a few ounces thanks to the lighter battery. I guess you could crunch some numbers to predict the effect of all these changes, but I prefer to just fly and observe. The combined intent of both changes (less down thrust and the battery change) is to reduce the towing speed and increase duration without spending money on a new battery. As long as I see those goals met, then I'm willing to accept some minor side effects, such as decreased performance when not towing, inexplicable mood swings, runny nose, etc. The March wind has been relentless around here, but as soon as we see a lull, I'll try things out and let you know how it goes.

Anyway, after spending about a month at home in Texas, I headed back to Florida for another two--week stay. I had a little more time to prepare for this trip, so I shipped a box of spare radio equipment, batteries, motors, and other odds and ends to help keep me busy at night. One of my uncles, Lewis Dunn, also brought over a few of his park flyers for me to borrow (or maybe to service, I never did determine which). Between the tinkering and small fleet of planes to fly, I had plenty to do in my spare time.

One of the projects I had planned to complete was to remove the wing warps and add more rigidity to the ORB by bracing it with wire. But after a few more outings, I decided not to bother. The way I

Photo 6: Another interesting heli at the Deland fun fly was this Hughes MH-6 complete with Delta Team commandos ready for action.

Photo 7: The small end of the spectrum well represented by this Pietenpol-ish design. The model is beautifully built and flew great. I apologize for not getting any details.

Photo 8: Several large electric models were present at Deland including this 110" wingspan Sig Rascal-110 flanked by an SE5a and a modified Stick of some flavor.

see it, the warps and flutters are part of the ORB's charm. So rather than change the Zebra's stripes, I'll just appreciate it for what it is... to fly! *(Editor's Note: Do I detect a bit of justification now that you have so many other projects to enjoy? Yeah, it's definitely time for another slap in the face!)*

My last full day in Florida was the first day of the Deland Golden Hawks inaugural electric fun fly. The weather was absolutely perfect, with sunny skies, mild wind, and temperatures in the upper 60's. They had a pretty good turnout too, especially for a Friday. There were several neat planes there including some large-scale helicopters. Unfortunately, I didn't think to get any technical details or pilot names for any of the models. I'll follow up later if I'm able to find anything. For now, just enjoy the photos.

I flew my rag-tag mix of planes throughout the day. As before, several other fliers offered their planes to me. When the day was done, I had flown about ten different airplanes, including my own. Of the 10, I only crashed one, a 3D profile foamie. The damage was minor, but I felt pretty bad about it since it wasn't one of mine. *(Editor's Note: Trust me, you'll get used to that. Unless of course they close the site for work projects like frequency pin spring replacement. That's happened to me twice now.)*

What surprised me most during the fun fly was the amount of attention that the ORB received. Several folks has positive comments, while others were more probing. I got the impression that there may soon be a few ORB clones in the Deland area (using Slow Stick viscera). I've considered doing that myself, so I can have an ORB in Texas. If I decide to pursue that, I'll report on it here.

That's all I have this month. Thanks for tuning in.

-Terry Dunn
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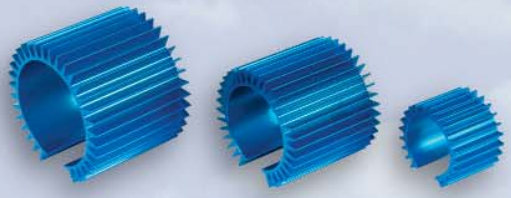

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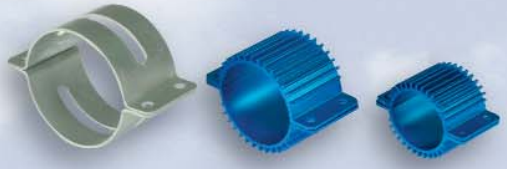

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SPARKY'S REVOLT

by Tony Coberly

Welcome back, y'all, and am I happy to be back, even though I guess we never really left! But nonetheless, let's get back in and crank it up! RC REPORT ONLINE is now a reality, with most of the same writers, and even the same old editor. *(Editor's Note: You can lay off the "old" wisecracks just any time now, youngster!)*

Late last year I had the pleasure of attending the first "Clover Creek Invitational" in Tennessee. This was a giant scale fly-in that featured pilots from around the world. The fly-in featured IMAA type flying schedules for all competitors, and the invited pilots were graced with great, freestyle flying! Now folks, we're talking about some *serious* extreme flying here, and the event drew hundreds of spectators. Several folks from my home club, Rocket City Radio Controllers, in Huntsville, Alabama, attended and we all had a great time!

Like many such events, this one included a raffle drawing. First prize was a magnificent, totally complete 30% airplane with everything included! I'm talking a full radio system, the assembled air frame, a DA 100cc engine, a Power Box servo control system, Duralight batteries, and all the necessary accessories. It was *sweet*! The second prize was an 88" Extreme Flight Yak 54 kit with a DA 50cc engine to go with it. Well, I'm a sucker for a raffle since the money almost always goes to a good cause, so I splurged $20 on tickets and then pretty much forgot about it. I just wanted to support the event. Besides, I was able to attend only on Saturday, and the drawing was on Sunday. Well, on Sunday evening I got a phone call at home. My good friend (and Gordon's neighbor) Art Azlin won the raffle's first prize! That lucky dog! Not only that, another member of our club won the *second* prize! I was happy for both of them, of course, and maybe a little jealous, I'll admit. But then the caller finally got around to telling me that the club member who'd won the second prize was... you guessed it... ME! I was suddenly the proud owner of that brand new Extreme Flight Yak 54 and a DA 50 engine! Talk about a well-invested $20! What a great weekend for the Huntsville Rocket City Radio Controllers!

But then came the terrible dilemma (snicker snicker); what to do, what to do? I now have this beautiful airplane and a great engine, but I very seldom fly "wet" airplanes any more, let alone *build* them! Well, with Julia's blessing I was allowed to store the Yak in our living room for several months while I pondered on what to do. And the obvious answer finally came out... it was conversion time, and *big* time!

So, this month I'm going to talk about the process of converting a large gas model into a lovely, electron burning aerial friend! Smaller models are getting easier and easier to convert these days, because so many of them are designed from the very beginning to be powered by electric or glow. Even up to a 1.20 size plane these days can be converted easily using Horizon Hobby's E-flite Power series motors. These solid and reliable motors are named by their closest glow engine equivalency. The Power 120 makes about the same power as a 1.20 2C, the Power 60 is roughly as powerful as a 2C .60, etc, all the way down to the Power 15. Well, my Extreme Flight Yak 54 is a little bigger than the average electric plane, so I'll need to work a little harder and do some math, weigh a few things, and get started on a realistic plan.

The first thing I recommend is to research the airplane and determine its typical flying weight. In this case the airframe was intended to be powered by a Desert Aircraft 50cc gas engine. I also learned that the Extreme Flight Yak 54 tends to weigh around 17.5 lbs. according to the instructions and several posts on the internet. But I plan to shave at least a full pound off that

Now that I have a general idea of the completed model's weight, I next need to consider the type flying I want to do with it. This is a highly aerobatic airplane, so I need to consider the watts per pound calculation for aerobatic flight. Now, 50 watts/lb. is good for gliders and sailplanes, while 100 watts/lb. provides a powerful trainer that will do typical loops and rolls. For better aerobatics we need about 150 watts/lb., but 200 watts/lb. is recommended for high speed and extreme 3D maneuvers with that necessary explosive escape velocity! I quickly decided to shoot for that high-end range of the spectrum, so 200 watts/lb., here I come! *(Editor's Note: You keep saying "200 watts/lb., but I keep hearing "$200/lb." Does Julia still allow you to handle the checkbook?)*

So, 200 watts/lb. means I need to multiply 200 watts x 16.5 lbs. = 3300 watts. This means keeping it as light as possible, though, so let's compute a heavier verison as well, with an 18.5 lb. model needing 3700 watts. So now we're looking for a motor capable of at least 3300 watts, but preferably 3700 watts, and that's *continuous* output.

Now that I know the approximate watts I need from the motor, next I need to consider the voltage I want. Generally speaking, the more cells the better. I'll be using LiPo cells, of course, but how many and what size? Smaller .25-40 size planes usually use 3-5 cells, and .90-1.20 size planes typically use 6-8 cells.

Why do we need more cells as the plane gets larger? Well, consider that as the wattage goes up, it's considerably easier to make the higher wattage with higher voltage. Let's look at the 3300-3700 watts I want for the Yak. I'll start with five cells and see what kind of current I end up with. A 5S (5-cells in Series) LiPo gives me a full charge voltage of 21.0 volts. Under load, I'll assume that the voltage drops by 20% as a general rule, leaving me with 16.8 volts. Using Ohms

law to compute the current draw (3300 watts divided by 16.8 volts), I'm looking at 196.4 Amps! This *is* a possibility, but that kind of current is way out there, and you'd be hard pressed to find an ESC and battery setup that can support that much current. No, I need to *increase* the voltage (the cell count) and decrease that current figure.

Now let's try an 8S LiPo and see if we're closer. An 8S LiPo at full charge is 33.6 volts, with an under-load voltage about 26.5 volts. Using Ohms law again we get 3300/26.5 = 124.5 Amps. This is a lot better, but still higher than the 100 Amps maximum that I like for such large models.

Let's try again with *ten* cells and even 12 cells. A 10S LiPo at full charge is 42 volts, and under load about 33.6 volts, and 3300/33.6 = 98 Amps. A 12S LiPo full charge voltage is 50.4 volts, and under load is about 42.2 volts. So, 3300/42.2 = 78 Amps. These two battery options are much more viable setups for the Yak.

Now these are just general planning calculations, and are not absolute. I now have a good idea of the cell numbers I'll use, but I also like to use another factor that most folks overlook. I like to look at the propeller and RPM that others are using on the recommended gas engine.

The recommended DA50 gas engine generally turns a 21 to 22" prop about 5500-6100 RPM, depending on pitch, prop material, blade shape, and tuned pipe, if any. So now let's go back to the 10S LiPo and look at the loaded voltage. If 33.6 volts is the useable voltage, and I take the 5500 RPM from the DA50 and divide it by the loaded voltage, I get 162.7 (5500/33.6 = 163.7). This means I need 162.7 RPM per volt (this is the motor reference number known as kV).

Now I have several good numbers to help find a suitable motor. I probably won't find one with these exact specifications, but I need something close, so I want a 3300-3700 watt motor with a kV rating of around 162, and suitable for a 10S LiPo battery.

But wait. Let's run the numbers again for a 12S LiPo. Still using the 5500 RPM figure, and a loaded voltage of 42.2 volts (5500/42.2 = 130.3), now I need a motor in the 130 kV range for a 12S LiPo.

Note that in both of these calculations I used the lower watt range of the requirement, *and* the lower RPM range of the DA50 engine. Let's compute it all again using the higher ranges. At 6100 RPM and 33.6 volts I'll need a 181.5 kV motor for 10-cells, or a 144.5 kV motor (6100/42.2) for the 12 cell battery.

Now I have even more information to help me make the right decisions. I need to shop around for a motor in the 130 to 180 kV range, and one that's capable of around 3700 watts. So now I have the necessary motor requirements information, but do I have enough info for the battery? Well, with all the calculations done, I just need to extrapolate the correct one I need. Wattage doesn't help much here, and motor kV doesn't either. But I do have the current draw figures, and I know I'll need a battery (or batteries) that can support the current we calculated earlier for 10S (98 Amps) and 12S (78 Amps) batteries.

Let's start with the 10S battery. LiPo packs have a C-rating to indicate the maximum current capacity of the battery for maximum output. LiPo's are usually 10C or better, and some go to 30C, but 20C is becoming the standard. So let's take the 98 Amps figure and divide it by a 20C rating. This calculation

(98/20 = 4.9 Amps) means I'll need a 20C battery using at least 4900 mah cells. If I use a 12S battery pushing 78 Amps, I'll need (78/20 = 3.9 Amps) at least 3900 mah cells. Now this is a minimum rating for the battery, mind you, and will not result in a great deal of run time. The obvious solution to that is an even higher C-rating, even larger cells, or the best of both worlds and go larger on both!

But at least now I have a valid set of minimum requirements for the motor and batteries for the electric conversion of my Extreme Flight Yak 54, that I know will perform well.

Now let's look at all these numbers pulled together. I need a motor in the 3500+ watt range with a kV rating around 160. I'll need LiPo batteries of 10-12 cells with a 20C or better discharge rating, and around 5000 mah capacity. Based on the computed amperage I'll need a high voltage ESC of at least 85 Amp rating for 12 cells, but more like 110 Amps for 10 cells.

Photo 1: Here's my EMP monster motor mounted to the Yak

At the Southeastern Model Show in Perry, GA, I was able to procure a nice, *large* brushless outrunner motor from True RC. This motor is large. No, it's a Monster! In fact, it weighs the same as the DA-50 gas engine that it's replacing! *(Editor's Note: I saw it and it didn't look all that big to me. At least, not for a starter motor on a 25 ton bulldozer.)*

Photo 1 shows the EMP C8085/08 170, measuring 80x85mm, with a 170 kV rating. Although it's not *exactly* what I was looking for, it's real close. It was actually designed to be more

Photo 2: The rear of my motor has a tiny prop to pull cooling air through.

like an 80cc gas engine replacement, and it installs very simply with my home-brew motor mount. I didn't have a "real" mount for this motor, so I made a few measurements, went to my local Home Depot, and measured some PVC pipe. I found that a 2.5" PVC electrical coupling was a nearly perfect fit between the X-mount of the motor and the firewall. I cut the length to the measurement I wanted, and used four 1/4x3" bolts with Ny-lock nuts to secure it to the firewall. That was almost *too* easy! But I'm not complaining!

Since this plane was not designed for electric, I needed to be a little clever here. I installed a tiny propeller on the rear of the motor, inside the PVC motor mount (see **Photo 2**) This little prop will provide air flow whenever the motor is turning, even when the model is sitting on the ground! The more cooling air over the batteries the better!

Then I mounted my Castle Creations 110HV ESC to the bottom of the box (see **Photos 3a & 3b**), and added a 2" hole for air flow into the fuselage. Don't forget, we need to keep things cool for reliability and the best performance. I'll do some flight testing to determine if I need more air flow.

The batteries? They're located in the area where the fuel tank would normally be, and their position helped establish the CG right where it's supposed to be. That was a pleasant surprise, but I won't complain!

The air continues on its way across the batteries and down into the tunnel built into the plane for a carbon fiber tuned pipe, exiting through the bottom of the fuselage.

Flying the Extreme Flight Yak 54 electric conversion is not at all disappointing, but neither is it spectacular. Don't get me wrong... it's a blast to fly on ten cells, and it performs just as the calculations predicted it would. Using the loaded voltages, airplane weight, and required wattage gave me good safe data that translated into a very good power system. During the planning stages of this project, I examined the components' rated numbers and thus the theoretical aspects. Now, however, I have data taken directly from the airplane during flight, using a flight data recorder. I'm presenting this date in five different graphs, and one compilation of all five at once.

Photo 3a : A very easy mounting option for the ESC.

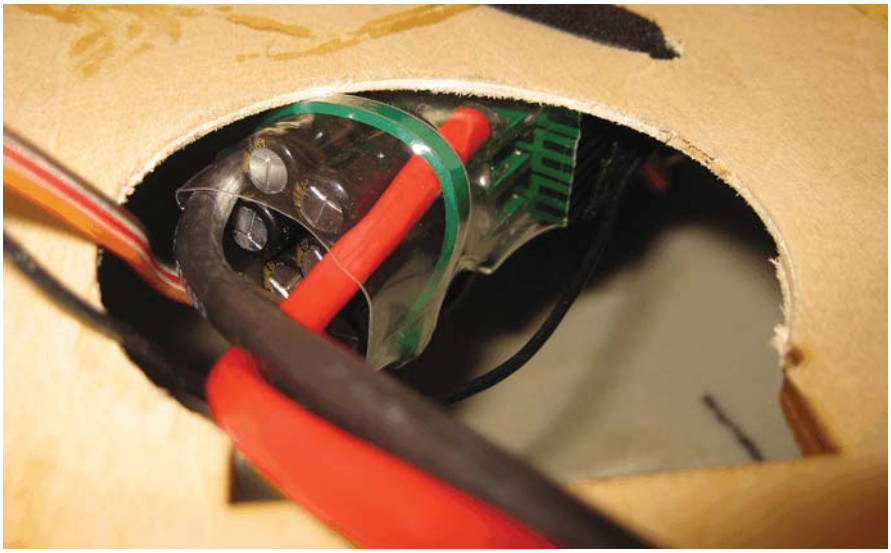


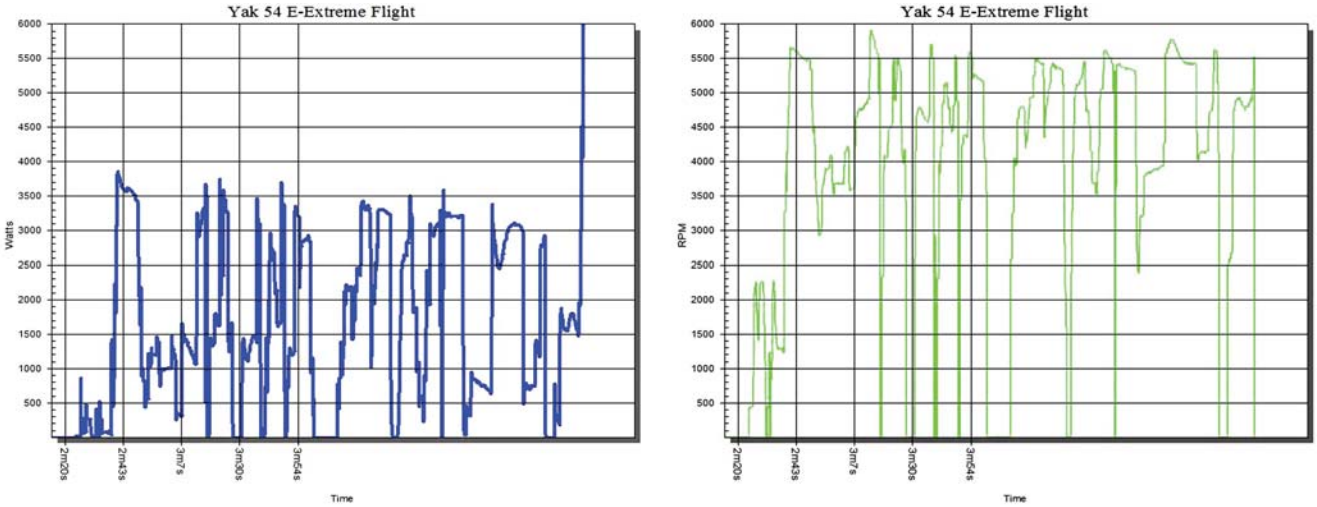
Photo 3: The ESC is placed by hole to make sure it gets cool air too.

Graph 1 shows the watts being drawn from the 10S LiPo over a flight duration of five minutes. The left axis of the graph goes up to a maximum of 6000 watts, because that's the max rating of the motor. We can see that early in the flight, I hit just about 3900 watts. The data recorder begins recording when the batteries are first plugged in, so it appears to be more than two minutes into the flight, whereas it actually took over two minutes to ready the plane for flight, and push the plane to a free flying gate at our field. The 3900 watt maximum was during takeoff. Full throttle allowed the plane to leave the ground after about a 50' roll! Now keep this in mind... this is a 6000 watt motor being run at only 3900 watts. Needless to say, there's untapped power here!

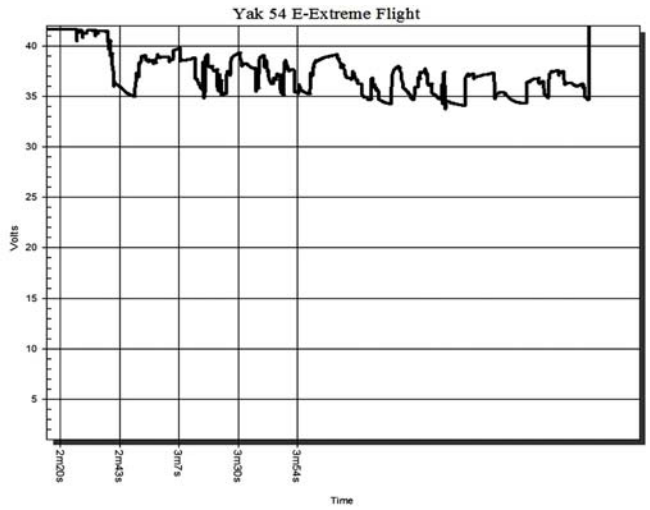
Graph 2 shows us the RPM changes during the same five minute flight. A little over three minutes into the flight I have a maximum recorded RPM of 5900. This recording was during a steep climb into a stall turn maneuver.

Graph 3 shows the battery voltage over the five minutes. The 10S LiPo has an unloaded takeoff voltage of 42 volts, and it holds a good, consistent voltage under a high load condition. When fully charged, the battery's voltage dropped to 35 under full throttle. Yet later on, when the battery was nearly depleted, it dropped to only about 34 volts! Now *that's* a good sign of a powerful set of batteries!

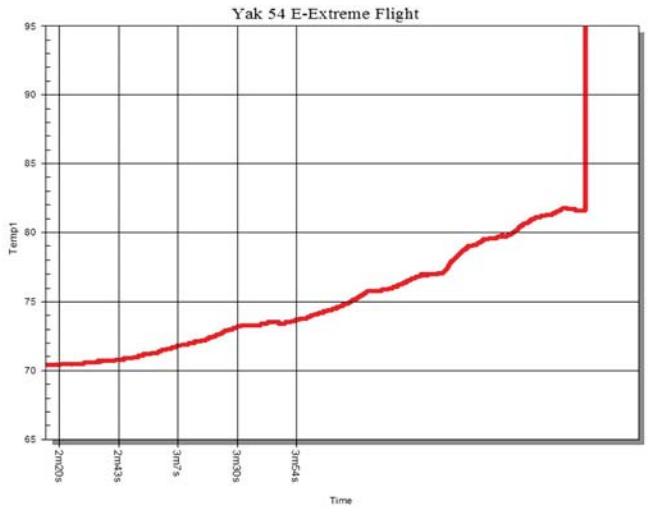
Graph 4 shows the temperature of the area near the batteries during the five minute flight. I started at about 71.5°F and ended



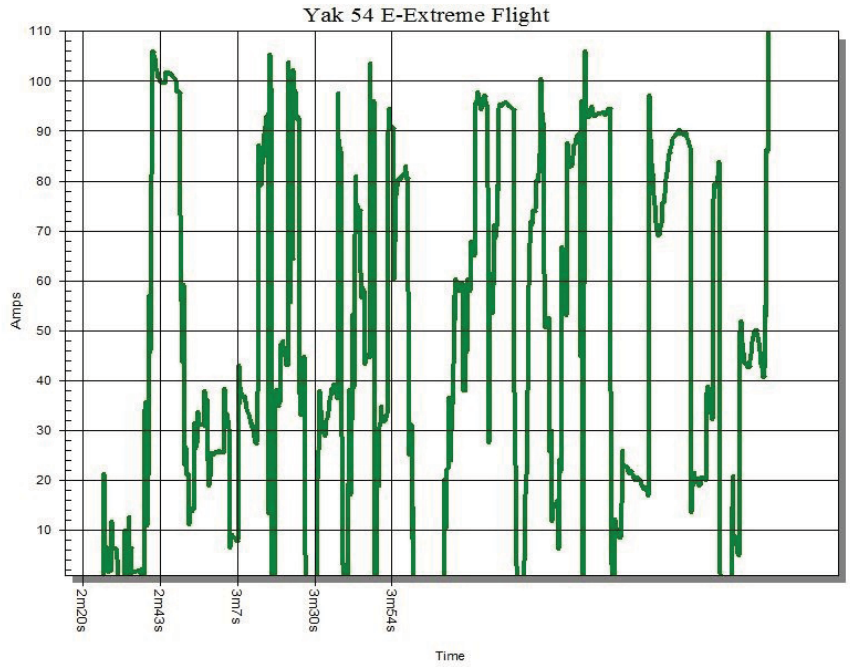
Graph 1 shows the watts being used during the 5-min. flight, and Graph 2 shows how the RPM varied.



Graph 3 shows the battery voltage changes, and...



Graph 4 shows the air temperature in the battery compartment.



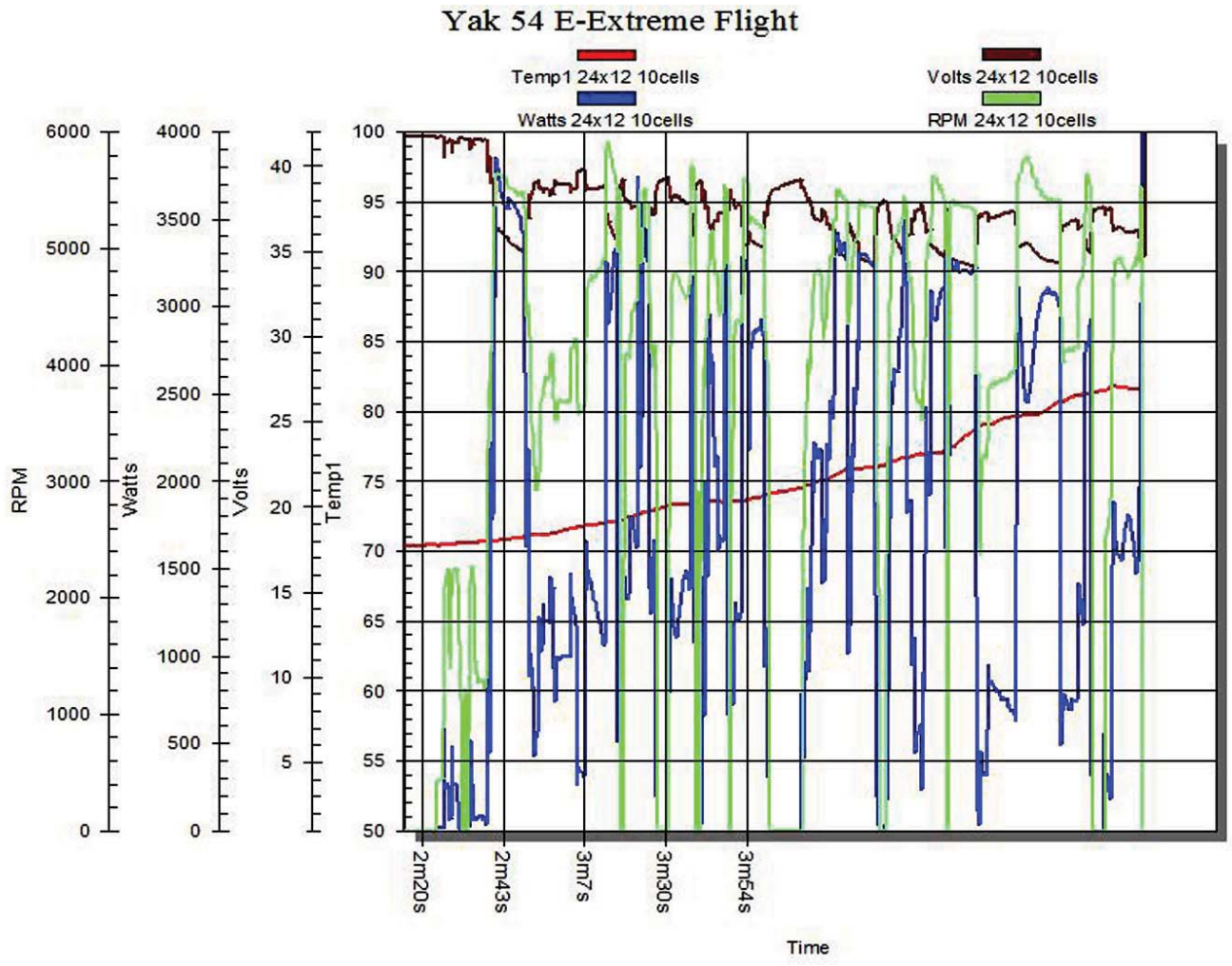
Graph 5 shows the changing current flow from the battery.

with 82°F. This is the air temperature, of course, not the temperature of the battery itself. But this is nice to have, to see if we have enough air flow through the airframe.

Graph 5 is a lovely thing! Here, finally, we have that all important current draw during the flight! The green line indicates that I hit a maximum of about 106 Amps early in the flight. Now that's cookin'! (The average home kitchen oven pulls about 40 Amps!) This tells me that I should have no problems with the Castle Creations Phoenix 110HV ESC.

Finally, I have **Graph 6** on the following page, which looks like something you might expect to find an hour after locking five kids in a room with white walls, after giving each one a different color felt-tip pen. But this is the graph that allows us to compare all the data at the same time, so we'll make this one big and easy to read.

Now let's see who's been paying attention. Who noticed that every real world data number is



Graph 6 is busy, I know, but this one shows all the date I accumulated during the 5-min. flight.

higher than we calculated? We assumed that the under-load voltage for a 10S battery would be about 33.6 volts, and all the later calculations were based off this number. *(Editor's Note: What's this "we", stuff, battery breath? "We" only assumed what you told us to assume!)* Since the numbers and computations were based on Ohms law, when one number is incorrect, all the resulting calculations will be inaccurate. In this case I'm using a LiPo battery that claims to be stronger than any other 20C battery on the market, and these numbers appear to support that claim! The loaded battery voltage never dropped below 34, and actually averaged better than 34.4! This seemingly minor one volt difference means a lot, however, so we can't simply disregard it as "just one volt". This is a case of using all the calculations that I did to be *safe*, but when choosing a speed controller, always... *always* go a size (or two!) bigger! If you calculate the need for 50 Amps, then use at least a 60 Amp ESC. Batteries just keep getting better, so the 50 Amp setup you use today, might easily become a 60 Amp setup tomorrow, just by using a newer and better battery.

Well, I think that's enough for this month. I'll have more data after flying with my 12S batteries, comparing their extra power against their higher weight. And then who knows? When Castle Creations makes their 150 Amp ESC available, I might try a 15S or 18S battery! *(Editor's Note: Tony, you remind me of a guy with a 180 HP motorcycle who wants to "improve" its performance. As the famous John Force once said, "Too much power is never quite enough.")*

-Tony Coberly
tony@hnsinc.net

You cannot legislate the poor into freedom by legislating the wealthy out of freedom. What one person receives without working for, another person must work for without receiving. The government cannot give anything to anybody that the government does not first take from somebody else. When half of the people get the idea that they do not have to work because the other half is going to take care of them, and when the other half gets the idea that it does no good to work because somebody else is going to get what they work for, that my dear friend, will bring the end to any nation. You cannot multiply wealth by dividing it.

-Dr. Adrian Pierce Rogers

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Other pilots won't believe that a plane this "scale" can also be easy to fly. Truth is, this Cessna 182 Skylane is a good fit for any pilot. Still, with a brushless motor and ESC onboard, you can also open it up and see what it'll really do. Other performance pluses include a LiPo battery, a balancing AC/DC charger and a true, 5-channel transmitter.

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FLYZONE™
flyzoneplanes.com

ARF

Pulse XT 25e ARF

EFL4100

Wingspan:	52 in (1335mm)
Length:	44 in (1115mm)
Wing Area:	525 sq in (33.7 sq dm)
Weight (without battery):	3.0–3.25 lb (1.3–1.4 kg)
Weight (with battery):	3.7–4.2 lb (1.6–1.9 kg)

From Pond To Pavement

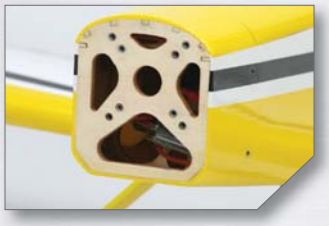
This Aerobatic Pulse is Perfect for the Sport Modeler

E-flite's Pulse XT 25e is a 25-size electric version of the classic Hangar 9 Pulse 40 XT. This is a great low-wing, sport-flying ARF that's perfect for intermediate pilots and sport fliers who want to fly an airplane that's more aerobatic than high-wing airplanes. Based on the original Mike McConville design, the Pulse XT 25e offers excellent features such as its lightweight laser-cut balsa construction and bolt-together wing and tail assembly.

The Pulse XT 25e is easy to maintain and quick to assemble. The wing bolts in place, making it easy to transport. The aluminum landing gear comes already painted along with a factory-painted fiberglass cowl and wheel pants.

Depending on your performance desires, you can select from an E-flite® Power 25 or Power 32. The pilot can also opt to fly the Pulse from the water by adding the optional E-flite fiberglass .25-size floats (EFLA500) and utilizing the included aft float mount.

E-flite®
ADVANCING ELECTRIC FLIGHT



FIREWALL
The Pulse XT 25e firewall accepts both the Power 25 and Power 32 outrunner motors, without modification, giving pilots the opportunity to select a range of power for performance.

E-flite's Power 25 Brushless Outrunner Motor
(EFLM4025A) gives the Pulse XT 25e plenty of power. It should be matched with an E-flite 40A Pro Brushless ESC (EFLA1040), a 3S 11.1V 3200mAh Li-Po battery pack (EFLB32003S) and an APC 12x8E prop (APC12080E).

R/C REPORT PRODUCT TEST REPORT

Item Tested. . . . Castle Creations Berg 7p Receiver
Type. . . . . 72 MHz FM 7-ch receiver
Purpose. . . . . Full range aircraft receiver
Manufacturer. . . . . Castle Creations, Inc.
235 South Kansas Ave.
Olathe, Kansas 66061
(913)390-6939
email: info@castlecreations.com
Distributor. . . . . Castle Creations direct and many hobby shops
Suggested Retail Price. $59.99
Warranty. . . . . Apparently none (see text)

Applicability. . Universal receiver for model aircraft
Dimensions. . . . . 0.85x0.58x1.52”
Weight. . . . . 9 grams (0.32 oz.)
Instructions. . . . . 8.5x11" card
Hardware Included. . . . Receiver and fail safe cord
Items needed. . . . . Appropriate Berg crystal ($7.99) to match your transmitter channel
Tested On. . . . . Futaba 12FG transmitter

CHEERS - Small, light, competitively priced, programmable, and universal (see text).

JEERS - No warranty mentioned on any accompanying paperwork, or at the Castle Creations website.

The Castle Creations Berg series of full range receivers are "auto shift" designs, so they work with both positive shift (JR, Airtronics, etc.) and negative shift (Futaba, Hitec, etc.) transmitters. According to their manual, the Berg will *not* talk to the Futaba 9Z transmitter, however. I don't know why, but so be it.

The Berg7p receiver offers seven channels with connectors in a horizontal format. This format allow plugging our servos into the end of the receiver rather than the top, making for a smaller and tidier package. The Berg 7p is very small and light (9 grams, or 0.32 oz.) for a 7-ch channel unit, and it includes the feature Berg calls "True Digital Signal Processing" (TDSP). This technology is an adaptive algorithm that determines if it's hearing a signal from a transmitter or some other RF noise. Then the receiver passes only those signals that pass these tests to the servos.

The basic functions of this receiver are the same as any other 7-ch 72 MHz FM receiver. You simply install it in your plane with the correct crystal for your transmitter's frequency, and then go fly. This a very user friendly receiver that works very well in this type of setup, but there is much more we can do with the Berg7p, this baby is programmable!

Now calm down. We're not talking about re-setting the dreaded VCR clock here! The 7-ch Berg has an optional "Fail Safe" mode similar to that of PCM receivers. When the fail safe mode is activated , it will fly normally until it receives interference. Then, rather than make the servos glitch and twitch like Gordon when he attempts a landing, it sends all the servos to pre-programmed positions established by the user. We don't need any additional equipment to set up our fail safe, either. We only need a single servo, a receiver battery, the Berg 7p receiver, and the included jumper wire. The receiver comes with the fail safe feature disabled, and we can verify this by simply connecting the jumper to channels 5 and 7, and any basic servo to channel 2 to serve as a verification device. We then power up our transmitter and receiver. The servo connected to channel 2 will start to move back and forth continuously. This is the response that tells us our programming is complete. We can now power down our receiver and transmitter. The receiver is ready for installation and flying.

If, however, we want to activate the fail safe feature, we need to make a small change to our setup. This time connect the jumper to channels 6 and 7, and again plug in the servo to channel 2. Turn on the transmitter and receiver, and again the servo will start to sway back and forth continuously, alerting us that it has taken our programming. But we're not done yet! Now we power down our receiver and remove the jumper. The next time we power up our receiver we'll need to set our servo positions to wherever we want them to go if the receiver loses the link to our transmitter. I prefer to set mine to where all servos return to the neutral position, but with the throttle set just slightly above idle. To do this all I have to do is turn on my transmitter, leave all the other sticks alone (centered), and advance the throttle a few clicks above idle. Then when we power on the receiver again, wait about 10 seconds for the receiver to recognize and store the new fail safe positions. When the receiver has saved everything, that servo plugged into channel 2 will begin to turn back and forth. Turn off the receiver power, and the settings are saved until we change them again. While flying, if there's any interference the receiver will send the servos to these programmed positions until it again receives clear signals from the transmitter... or old man gravity catches up to it!

Overall I find this a very nice receiver option, but wait... there's more! If you have a "Castle Link" from Castle Creations (I've had one for several years), there are still more options! The "Castle Link" allows me to re-program and update the firmware in my Castle Creations speed controllers, using my laptop computer. The Castle Link is a USB adapter for a PC computer that will interface with most Castle Creations products. The Berg 7P can be connected to a Castle Link with the provided adapter, and allow us to do even more programming.

We fire up our Castle Link software, and plug in our receiver and battery. We then have several options where we can make many changes, such as fail safe, output frequency, and best of all, reassign the receiver's channels! I love this feature, which often allows eliminating extra extensions and Y-harnesses. It even allows some basic, non-computer transmitters to control some more advanced aircraft.

For example, let's say we have a model with one servo on each aileron, one servo on each elevator, two servos on the rudder, and one servo on throttle. Normally we'd need Y-harnesses on the ailerons, elevator, and rudder channels. To reconfigure the receiver for this setup, the first four channels are set to a standard setup. Then change channel 5 to be another aileron channel, set channel 6 to be another elevator channel, and set channel 7 to be another rudder channel. Now we don't need any Y-harnesses.

Unfortunately we cannot reverse each channel individually, so we have to orient our servos to get the correct directions. Still, this is a very powerful option!

This Berg7p is a nice receiver that's very small and light, and offers some powerful programming features in addition to its auto-shift feature that allows it to be used with almost any 72 MHz transmitter. I consider this receiver to be a great addition to any 72 MHz radio system. *-Tony Coberly*
tonyc@rcreport.net

PRODUCT TEST REPORT

by Tony Coberly

Model.. . . . . Mini-Showtime 4D ARF
Airplane Type.. . . . . Extreme Aerobatics
Manufacturer. . . . . E-Flite Models
Distributor. . . . . Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price. $209.99
Typical Street Price. $159.99
Wing Span.. . . . . Advertised: 43"
Measured: 43"
Wing Area.. . . . . Advertised: 414 sq. in.
Measured: 411 sq. in.
Advertised Weight. . . . . 23-24 oz. W/o btry,
26-29 oz. W/btry
Airfoil. . . . . Symmetrical
Wing Structure.. . . . . Built-up balsa
Wing Joiner Method. . . . . Carbon fiber joiner tube
Fuselage Structure. . . . . Built-up balsa
Fuselage Length. . . . . Advertised: 42"
Measured: 43.75"
Pushrod Type. . . . . Music wire
Pushrods Installed. . . . . No
Hinges Included. . Yes, but not installed (CA type)
Recommended Controls. . . 4 (Ail, El, Rud, Throt)
Motor Included.. . . . . None
Recommended Motor(s). 480-size
brushless outrunner
Motor Mount Installed. . . . . Yes
Motor Mount Type. . . . . Plywood box
Battery Included.. . . . . None
Recommended Battery. . 1320-2100 mah 3S LiPo
Landing Gear Installed. . . . . No
Wheels Included.. . . . . Yes
Assembly Instructions. . . . . 36 pages (8.5x11")
with many photos and illustrations
Hardware: Metric or SAE. . . . . Mixed
Hardware Included. . . . . Spinner, prop adapter, landing gear, wheels axles, wheel pants, pushrods, control horns, tail wheel, wheel collars
Items Needed To Complete. . . . . 10x7 propeller, 480-size brushless outrunner motor, 40 amp ESC, suitable 3S LiPo motor battery, 4-ch radio system with four sub-micro servos, two 18" and two 6" servo extensions, and one Y-harness.
Covering Material. . . . . UltraCote
Estimated Assembly Time. . . . . Four hours
Estimated Skills Required. . . . . Experienced
(For building and flying)

Drilling Required. . . . . Yes
Adhesives Required. . . . . Thick and thin CA
Assembly Tools Required. Common modeling tools

COMPLETED MODEL

Finished Weight. . . . . 30.1 oz. w/btry
Wing Loading. . . . . 10.5 oz./sq.ft.
Motor Used. . . . . E-Flite Park 480 (1020kV)
Propeller(s) Used. . . . . APC 10x7E
Propshaft to Ground. . . . . 6.88" (held level)
Speed Controller Used. . . . . E-flite 40Amp Brushless ESC (V2)
Battery Used. . . . . Thunder Power 2100 mah 3S 11.1v 15C
Radio Used. . . . . Futaba 12FG transmitter and a 7-ch FASST receiver
Covering/Finishing Used. . . . . Come pre-covered
Special Items. . . . . None

CHEERS - Good looking four-color covering scheme; easy to see in flight; great flight performance.

JEERS - Came out slightly heavier than advertised; spinner assembly is very flimsy.

The Mini Showtime 4D ARF is the smallest of the Showtime family of extreme aerobatic planes designed by Mike McConville. The Mini Showtime is constructed of a built-up balsa fuselage and wing with a light plywood box for a motor mount. All the joints in the plane have the tell-tale brown line that is seen throughout the ARF world indicating laser cut parts. The joints are so nice and tight you can barely see any glue in them! Even though everything seems tight, I like to go over all accessible joints with thin CA glue.

To get started, the manual begins with landing gear installation. Finally! I usually put the gear on very early regardless of the instructions! I think having the gear in place helps reduce the hanger rash that comes from setting the fuselage on the work bench during assembly. The strap-type landing gear simply bolts to the belly of the fuselage with two bolts, and then we can set the fuselage upright.

Next I assemble the wheel and axle assembly. This is a very simple but effective unit. One bolt goes through the wheel with a washer and a ny-lock nut that's tightened just enough to keep the wheel from wobbling around. Then add a nut as a spacer, slide the axle through the landing gear, and add the ny-lock nut. Then add the wheel pants. This is the easiest set of wheel pants I've ever installed, because they just slide

onto the axle over that nut spacer. Hold each pant even with the work bench, mark where the locking screw hole should be, drill the holes, and install the pants. Very nice!

Since I'm at the front of the fuselage the instructions lead me on to the motor installation. I'm using the recommended E-flite Park 480 Brushless Outrunner. This motor is capable of a maximum of 275 watts output using a 3S LiPo battery. The motor mount box is set up perfectly for this motor. I simply attach the X-mount provided to the rear of the motor, and use the four screws provided to attach the X-mount to the firewall. I can now move on to mounting the speed controller.

I'm also using the recommend E-flite 40-Amp Brushless ESC (V2), which fits nicely on the bottom of the motor mount box. Just use some hook and loop fasteners and perhaps a small strap to hold it in place firmly. Then move on to the cowling. There's nothing tricky here, yet the manual gives detailed instructions with five good pictures of how to line up the spinner and set up the screw locations for the cowl.

I didn't like the supplied spinner. I've tried in the past to use this setup and found it unworkable for me. The thin plastic and nearly prop specific cone doesn't allow for easy changes to test different props. I not to use a spinner at all, and just left the bare prop adapter for now. I'll add a better spinner later.

Now I get to put the fuselage aside for a while and work on hinging the ailerons on the wing panels. I'll need four hinges per aileron, and the slots are already cut. We're instructed to drill a hole in the center of each hinge slot, and to use T-pins to hold the CA hinges centered while being glued. One nice note is to place a #11 hobby blade between the trailing edge of the wing and the leading edge of the aileron to keep a space of about .02in. This space will allow maximum throw while minimizing any binding. Now do the other wing panel and then move on to the aileron servo.

I'm using E-flite S75 sub-micro servos. These servos weigh only 7.5 grams each, but produce 17 oz. of torque. The wings have holes tat fit these servos perfectly, so I just added a 6" servo extension to each servo lead. Make sure you

Tony is seen here about to make the maiden flight with his E-flite Mini-Showtime.

secure this connection with a piece of string or other connecting device so it doesn't get pulled loose in flight. Pull the extension through the wing with the pre-installed string, and fasten the servo in place with the screws provided.

We can now install the aileron control horn. This horn just glues into a slot in the aileron with 5-min epoxy. A long arm on the servo, with an easy connector and a push-rod to the lower hole on the control horn, and I'm set to go! I can now install the wings on the fuselage with the wing tube, and attach the screws from the hatch on the bottom of the fuselage.

The next task is to install the horizontal stabilizer. This is a flat, built-up stabilizer that needs to align carefully with the wing to insure good, predictable flight characteristics. The stab slides into the provided slot easily, so I lined it up with the wing and centered it in the slot from left to right. Finally, I measured the distance from aileron tip to stab tip, and verified that the measurements were the same. Now I can mark the edges of the fuselage with a felt tip pen and take the stab back out of the fuselage. I need to carefully cut the covering off the line I made so that I can glue the stab to the fuselage. Before I put the stab back in place, I need to slide the elevator assembly into the slot and let it hang loose. Once I get the stab into the fuselage, I can hinge the elevator to the stab before gluing the stab to the fuselage. This was a little awkward, but not too bad. Once the hinges were glued in place, I aligned the stab again and glued it to the fuselage with thin CA. I used quite a bit of CA in this step, so I had my fan running to blow the fumes aside before they reached my face.

Next comes the vertical fin and rudder assembly. I set the tail wheel bracket into the rudder and used epoxy for security. Then I hinged the rudder with three CA hinges. When the CA and epoxy were cured, I set the whole assembly into the slot in the fuselage, marked the edges with a felt tip pen, and then removed it so I could

cut the covering from the area to be glued. I later used thin CA here too, allowing it to penetrate and dry.

Now I can start installing the tail servos. I used two E-flite S75 servos and two 18" servo extensions. Now I'm warning you, you'll need to go to your happy place for this next step. If you've had more than two cups of coffee, or a whole can of Red Bull for pep, you may want to put off this next step for a few hours. There's a cutout on the bottom of the fuselage for air to exit, and down inside this cutout there's a small slot. That slot is where we need to pass the servo extensions from the radio compartment back into the tail. Now, this is not normally much of a problem, but in this case the bulkhead is sealed off , so I only have a very small slot to work with to fish the leads back. I used use a length of Sullivan nyrod to reach to the rear of the fuse, and attached the servo extensions to the nyrod. They need to taped carefully though, because the slot through which they have to be pulled is barely larger than the servo connector itself! Then pull them forward into the belly of the plane where they can reach the receiver. My extensions were a little long so I just wrapped them into the same strap as the receiver. The rudder and elevator servos install the same way as the aileron servos. Using epoxy, the control horns are attached to the control surfaces. The control arms and servo arms are then connected by a pushrod with a Z-bend on the control horn, and an EZ-connector on the servo arm.

The final step on the tail is to reinforce the horizontal stab with two carbon fiber rods on each half. The rods go from the corners of the stab, near the elevator counterbalances, back to the fuselage.

Now that I have all the servos in place, I can install the receiver in the area provided. A little "hook and loop" material on the receiver and the tray will hold everything nicely in place. Add an additional strap, and I can now plug in our servos. With everything plugged in, I can turn on the transmitter and plug in a battery to the ESC in order to power the system up, without a prop installed.

This is where the EZ-connectors are a great help because in a matter of two minutes I can have the surfaces centered and ready, without using the computerized trims in the transmitter.

The battery compartment has a hatch that's guaranteed not to come off in flight. If it does, then you must have found "the rock or the hard place" in the air, or perhaps by "sharing airspace" with another flying vehicle. This little hatch is held on with magnets in the rear, a dowel pin in the front, and it slides under the rear of the cowling by about 1/4". Once I get the hatch open, I need to secure the battery with two hook and loop straps. I had to move the Thunder Power 2100 mah 3S LiPo to the very rear of the compartment to get the recommended 4.5" CG point noted in the manual.

Now for the final step, attach the Side Force Generators (SFG) to the wing tips. The SFG's are optional, but they're designed to make the plane fly better. The additional side area is designed to help the plane in high alpha rolling maneuvers, as well as slow flight in general. In high alpha rolling maneuvers the SFG's allow the plane to catch more air when the wing is in a vertical plane. This means I need less rudder throw to hold the nose up while rolling. When just doing general flying the SFG's help keep air from spilling off the wingtips and causing tip stall when approaching stall speed. The plane will stall eventually, of course, but the general theory with the SFG's in place says that both wings will stall evenly, causing the nose to drop rather than a wing tip. Theory is one thing, but we'll soon see, because once the SFG's are installed, the Mini-Showtime is ready to go.

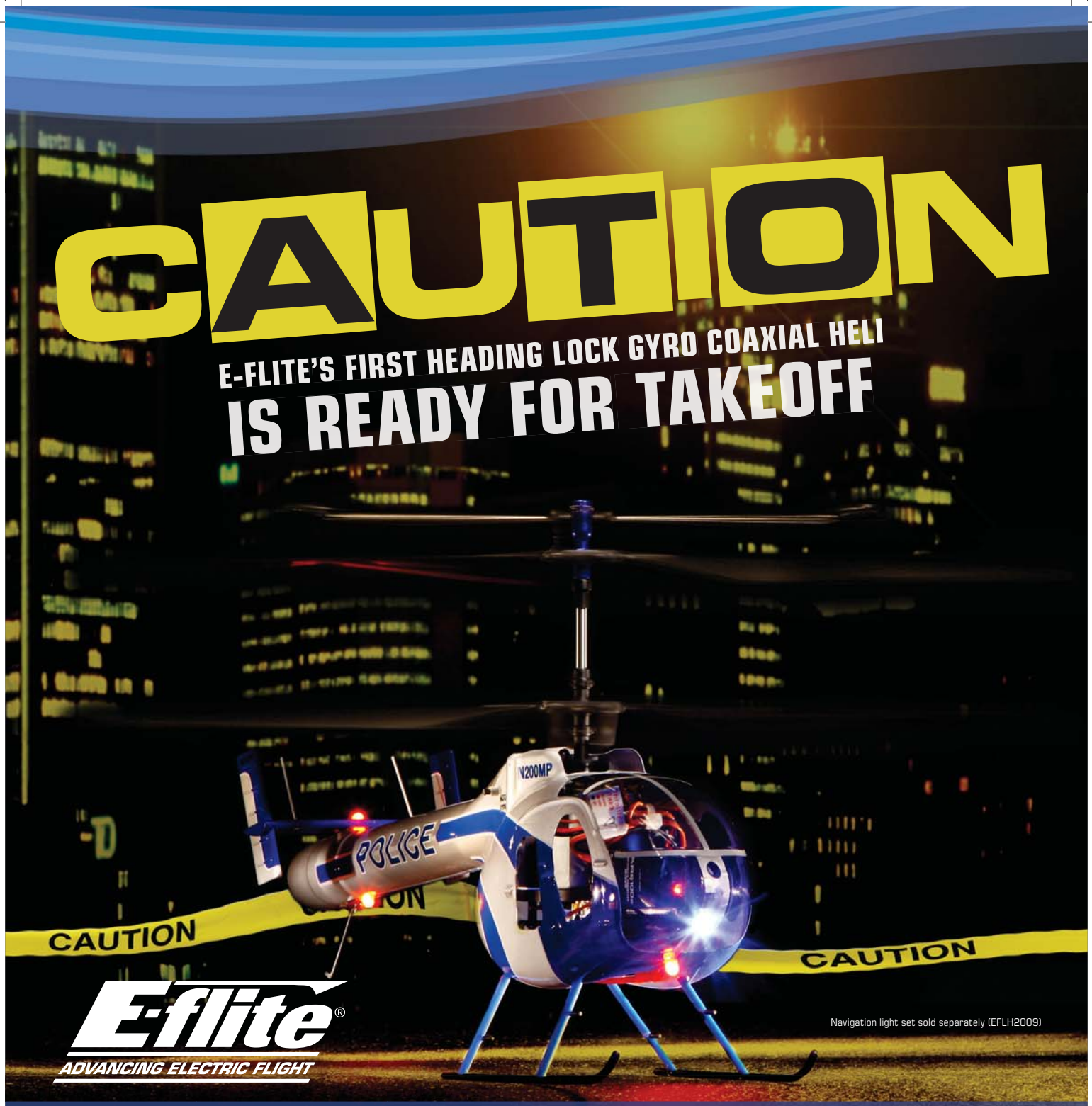
Flying the Mini-Showtime

The recommended balance point is conservative and lends itself to normal aerobatic flight, but nothing extreme or hard to handle. The recommended control surface throws are fine for a reasonably experienced pilot. The low rates are not soft, so expect a spirited level of response. Remember, this is *not* a trainer!

The E-flite Park 480 motor has plenty of power to pull the Mini-Showtime through nearly any maneuver. Using a 10x7 prop works okay, but it provides more speed than is needed, and actually causes a few problems. At speed the tiny E-flite servos can't hold the oversize control surfaces in position for radical maneuvers. We can use servos with more torque to overcome the airspeed, or we can simply slow down! I recommend using an 11x4.7 for better 3D performance. The lower pitch slows the model's speed, and kicks in more thrust to yank the model around. The Side Force Generators allow one to fly knife edge about as easily as I've ever flown, and with a bare minimum of pressure on the rudder stick!

I could go on and on about the Mini-Showtime's capabilities, but I'll just sum it up quickly by saying that it's a great little flyer and very capable of most any 3D maneuver. It's a blast!

-Tony Coberly
tonyc@rcreport.net



Don't get caught red-handed without the hottest heli on the market. E-flite's Blade® CX3 MD 520N® RTF gives pilots unbelievable micro-heli excitement. This Blade is a micro-sized heli that offers first-time helicopter pilots exceptional stability and incredible control through the coaxial, counter-rotating head design and 3-in-1 control unit. The Blade CX3 also provides better control and locked-in performance thanks to the Heading Lock gyro.

This Blade is covered in a licensed MD 520N scale body with a cool metallic police trim scheme. This indoor heli is 100% factory-assembled, test flown and ready to fly out of the box. Not to mention, most replacement parts, hop-ups and accessories for the CX/CX2 work for the CX3. The CX3 includes a transmitter with Spektrum™ 2.4GHz DSM2™ technology and Spektrum AR6100e receiver. Already have a transmitter? The Blade CX3 MD 520 RTF is a stylish Bind-N-Fly™ heli that's compatible with a variety of DSM2 aircraft transmitters.

So go ahead and take off with E-flite's Blade CX3 MD 520N. These won't sit on the shelves for long. Head over to your nearest dealer or E-fliteRC.com to learn more.

www.E-FliteRC.com

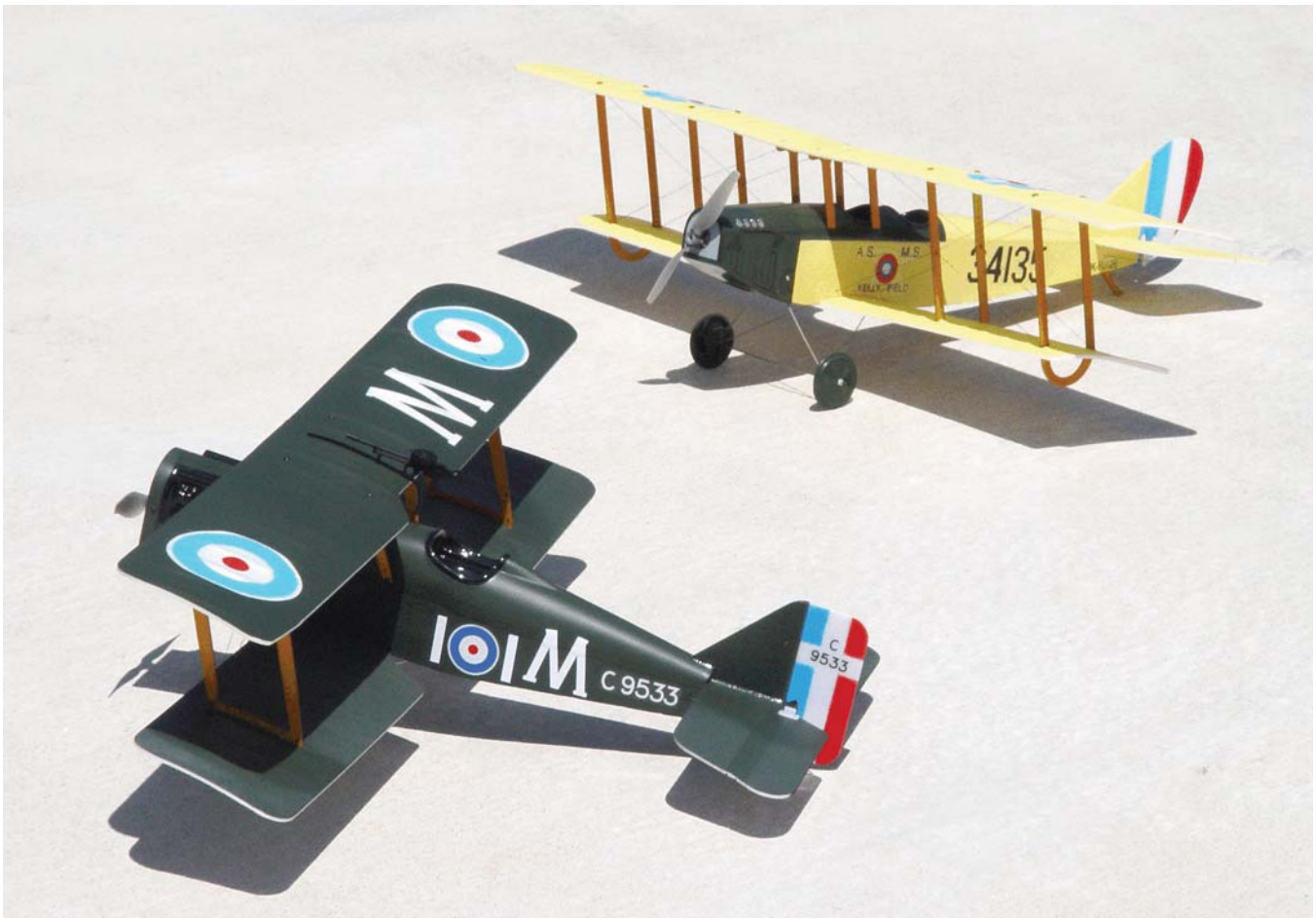
HORIZON HOBBY

PRODUCT TEST REPORT

by Gordon Banks

Model. . . . . SE5a Biplane WWI Fighter
Airplane Type. . . . . ARF Electric Slow Flyer
(designed primarily for indoor flight)
Manufacturer. . . . . E-flite (Made in China)
www.E-fliteRC.com

Distributor. . . . . Horizon Hobby
4105 Fieldstone Road
Champaign, IL 61822
(217)352-1913
www.horizonhobby.com



Here are both of my E-flite "Slow Flyers", the SE5a and the JN-4 Jenny.

Suggested Retail Price. $84.99
Typical Street Price. $64.99
Wing Span.. . . . . Advertised: Top Wing - 30"
Bot Wing - NA
Measured: Top Wing - 29.88"
Bot Wing - 29.88"
Wing Area.. . . . . Advertised Total: 310 sq. in.
Measured: 317.1 sq. in.
(Top: 157.55 sq.in., Bot:159.55 sq.in.)
Advertised Weight. . . . . 7 oz. w/o battery, or 7.5 to 8.5 oz. w/rec. battery
Airfoil. . . . . Under-cambered
Wing Structure.. . . . . Both are pre-formed, one-piece, sheet foam
Wing Joiner Method. . . . . None required
Fuselage Structure. Pre-printed foam with plywood and foam bulkheads, and plywood cabane struts
Fuselage Length. . . . . Advertised: 23"
Measured: 23"
Pushrod Type. . . Micro music wire (0.03", 0.8mm)
Pushrods Installed. . . . . Yes (but see text)
Hinges Included. . . . . Pre-applied tape
Hinges Installed. . . . . Yes (pre-applied tape)
Recommended Controls. . . . 3 (Elev, Rud, Throt)
Recommended Motor. . . . . E-flite Park 250 brushless outrunner (2200Kv)
Motor Mount Installed. . . . . No
Motor Mount Type. . . . . Carbon fiber tube
Battery Included.. . . . . No
Recommended Battery. 2S 7.4 volt 430 mah LiPo
Landing Gear Installed. No, but it is preassembled
Wheels Included. . . . . 2.27" mains, tail skid
Assembly Instructions. . . . 11.25x8.25", 29 pages, with many photos
Hardware: Metric or SAE. . . . . Metric
Hardware Included. . . . . Pre-assembled and pre-painted fuselage with plywood cabane struts and tail skid, pre-installed micro-wire pushrods, plastic cowl face with simulated radiator, 1.7" carbon fiber motor mount tube, pre-painted one-piece foam wings and tail feathers, pre-shaped and pre-stained plywood struts, molded plastic machine gun, pre-formed and soldered 0.47" music wire main gear, two 2.27" plastic wheels, two nylon control horns, two pushrod EZ connectors, white string for rigging wires, two 1" squares of double-sided tape, and 14 tiny screws (two are in the cowl).
Items Needed To Complete. . . . . Propeller, motor, 10 Amp micro brushless ESC, 2S LiPo battery, a

3-ch radio system with two sub-micro servos, a 1x2" length of Velcro for the battery, optional pilot bust and black string or thread for the flying wires

Covering Material. . . . . None (painted foam)
Estimated Skills Required. . . . . Experienced
Drilling Required. . . . . Servo mounting only
Soldering Required. . . Depends on motor and ESC
Adhesives Required. . . . . Foam-safe CA, matching CA kicker, and silicone sealant or equivalent
Assembly Tools Required. #1 Phillips screwdriver

COMPLETED MODEL

Finished Weight. . . . . 8.32 oz. (w/1.0 oz. btry)
Wing Loading. . . . . 3.78 oz./sq.ft.
Motor Used. . . . E-flite Park 250 Brushless 12-pole outrunner (0.6 oz. w/prop adapter) ($54.99/44.99)
Propeller(s) Used. . . . . APC 6x5 Slow Flyer
Propshaft to Ground. . . . . 5.75" (when held level)
Speed Controller Used. . . . . E-flite 10 Amp Pro Brushless (0.46 oz. w/connectors) ($27.99)
Battery Used. . . . . E-flite 2S, 43 mah LiPo (1.0 oz. w/connector, $29.99/21.99)
Radio Used. . . . . Spektrum DX7 transmitter, with a Spektrum AR6100 Microlite 6-ch receiver (0.14 oz., $49.99), two E-flite S60 Sub-micro servos (0.21 oz. ea, $17.99/14.99), and an E-flite 2S 430 mah LiPo battery (1.0 oz., 29.99/21.99)
Covering/Finishing Used. . . . . None (pre-painted and decorated)

CHEERS - Nicely packaged box to resist shipping and handling damage; pre-assembled and pre-painted basic fuselage; pre-painted one-piece wings and stabs; super light weight; nicely assembled micro music wire landing gear; completed and assembled model is small enough to be transported in any vehicle; assembled model looks great in the air and on the ground; outstanding (and very, very slow!) flight characteristics in totally calm conditions; surprisingly aerobatic; lands like a feather.

JEERS - Weak instructions; *white* string supplied for the rigging wires (why not black?); fragile foam parts require care and patience during assembly and when landing; CA kicker temporarily softens the paint; the common but miserable O-ring method of attaching the propeller to the motor (see text).

Assembling the E-flite SE5a requires a foam-safe CA and matching kicker, so I used Pacer Technology's Zap-O and Foam Safe Kicker. Note that any CA kicker may temporarily soften the pre-applied paint, so let the kicker evaporate on its own, and never attempt to wipe off any excess. I like to use paper towels to cover the painted areas near the spot being glued, to minimize the areas of softened paint. Once the kicker evaporates, the paint seems fine again, although with a slightly darker hue than before, and darker than the surrounding areas.

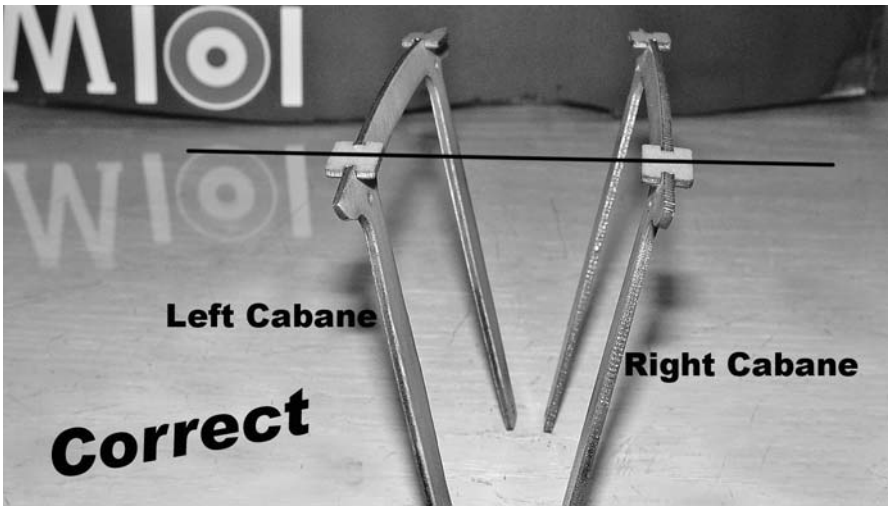
This kit is not intended for beginners, so I'm not going into any great detail here, but in my opinion the instructions are insufficient for an inexperienced builder. Some tasks are missing, some steps are in poor sequence, and numerous steps are vague and/or poorly described. Although aggravating at times, none of the problems I encountered will be significant to an experienced builder.

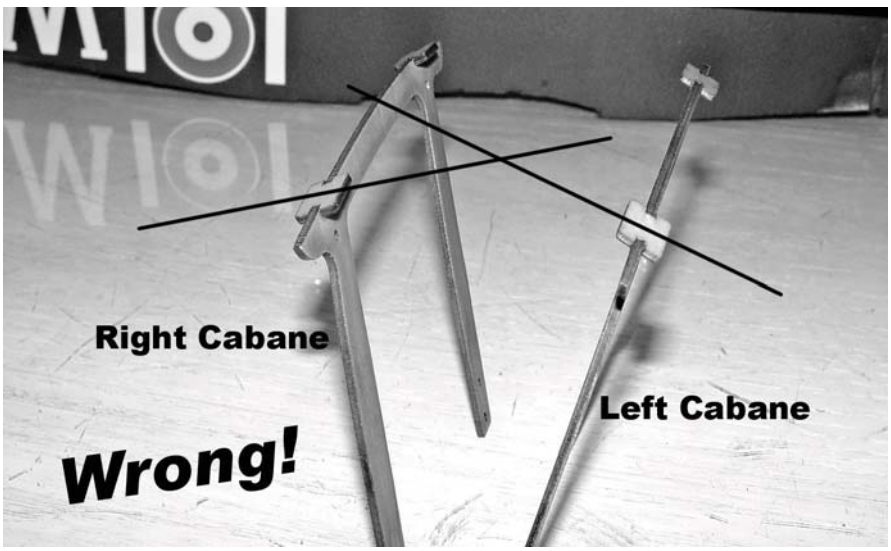
I'm an old-fashioned modeler who actually *enjoys* building, and that generally includes assembling ARF's. The E-flite SE5a is simple and quick to assemble, but so many parts are tiny and fragile, I can't honestly say that I enjoyed it. My Sasquatch hands often do more damage than good when working with such lilliputian parts in such tight conditions. Nevertheless, I managed to get this one together with no damage.

First we have to remove the pre-installed cowl (radiator) to gain access to the motor and ESC compartment (this is where the extra two screws come from). Then we're to install the ESC using some of the sticky-back tape. Despite the cramped working area, no problems there. The carbon fiber motor mount tube is then glued to the motor using silicone adhesive or an equivalent, which takes several hours to cure. Also, since the tube has an inner diameter of 0.248", and the motor shaft housing measures 0.229", it's a sloppy fit at best, so just do what you can to get it straight. (Not wanting to wait several hours for silicone adhesive to cure, I cheated and used 5-min epoxy. To make sure no epoxy would get into the motor shaft housing, I dabbed a tiny blob of Vaseline on the end of the motor shaft housing first.)

Now the motor and motor mount tube are to be temporarily installed, without glue, into the fuselage. Then install the cowl, and do your best to follow the instructions on installing the prop and gluing the motor mount to the fuselage. Go ahead and give it a try... we'll wait. Frustrating, isn't it? I couldn't get the prop on either. The opening in the cowl has a flange on the back that prevents the motor from protruding far enough through the cowl to attach the prop!

At this point I determined that the motor mount tube is just barely long enough to do the job anyway, so I glued it into the fuselage to position the motor as far forward as possible. Then I trimmed the opening in the cowl to make it large enough to clear the motor. It's still difficult to attach the prop, but at least now I can do it. I hate the O-ring method of attaching the prop. No matter what you do, that





O-ring is eventually going to fail. O-rings are simply not designed to be stretched like springs or rubber bands. When it breaks the prop and the prop adapter (two adapter washers and two O-rings come with the motor) go flying off. Indoors you'll find them. Outdoors... well, maybe.

The instructions are pretty good about installing the servos, receiver, and battery, but once done, they go off and leave the battery connected. On page 13, somewhere after Step 16, add the following: "Step 17. Now remove the battery until you're ready to fly."

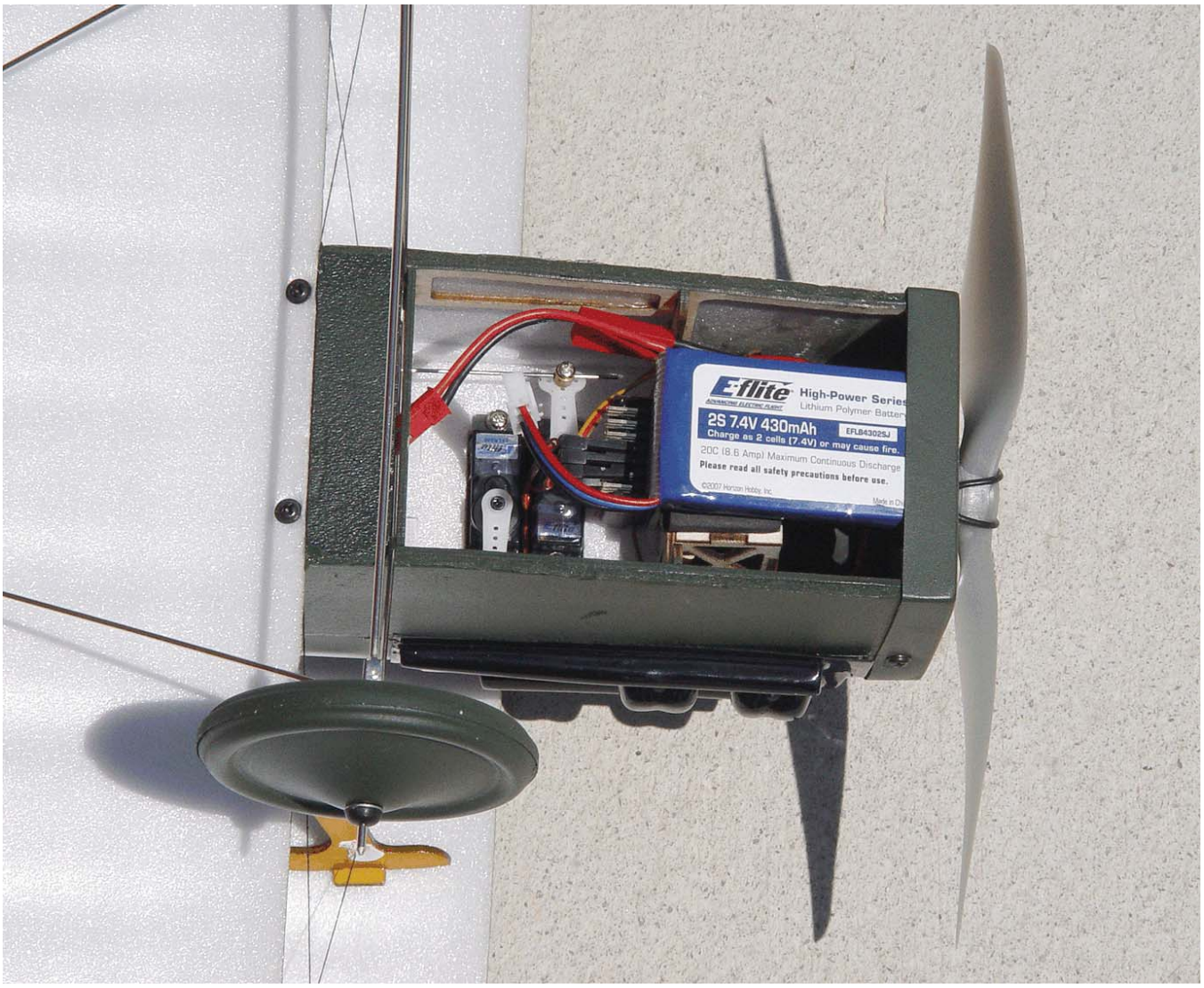
Also on page 13, in step 1, we're told to install the cabane struts. What we're not told is that the two pieces are *not* identical. There's a left and right cabane, and they must be installed on the correct sides to have the little wing mounting pads (on top of the struts) oriented properly with the top wing. With the fuselage sitting upright on your work table, take one strut in each hand and hold them in place against the fuselage (note that they both angle outward at the top). If the little wing mounting pads on one side appear almost parallel with the pads on the other side, you have them correct (**see photos**).

Now, when installing the wings there are many opportunities to screw up! Remember, this model has no ailerons to help overcome any misalignment of the wing panels in flight, so go slow, take your time, and make sure everything is properly aligned. I spent nearly an hour here, checking and double-checking before tightening any screws or gluing the outer struts in place. This is a one-piece model when completed, with no after-adjustments or disassembly intended. Get it right during assembly, or live with your mistakes later!

Whoa! The section on attaching the fin and stabilizer presents an opportunity for major aggravation! We're first told to glue the vertical stabilizer to the horizontal stabilizer, and *then* install the two control horns. Well, this might have been okay if the control horns fit properly, but they don't! The press-thru tabs on the control horns are much too wide for the pre-cut slots, and fixing this after the stabilizers are joined is much more difficult than it would be before the stabs are joined. Remember, this is all rather delicate foam board, so rough handling is strictly a no-no! I highly recommend enlarging the control horn slots *before* gluing the stabs together.

In step 5 on page 18, when we're to glue the stab assembly onto the fuselage, there's a slot in the fuselage to accept the lower part of the vertical stab. On my fuselage, the plastic turtleneck extended a bit too far rearward, which pushed the stab assembly a little too far rearward to fit into the slot. A little careful trimming of the plastic turtleneck allowed the stab assembly to slide forward enough to fit neatly into the slot. I decided to use a little smear of 5-min epoxy to glue the stab assembly in place. I guess I just wanted an extra minute or two to make sure it was properly aligned.

Keeping in mind that the little E-flite S60 servos produce only 12.5 oz./in. of torque, I felt that the friction (internal drag) on the two pushrod wires was a bit too much, so I removed the wires, cleaned them thoroughly with steel wool,



Every bit of the radio gear mounts up front here.

and gave them a liberal coating of dry silicone spray lubricant. As usual, this went a long way toward reducing the internal friction of the guide tubes.

When installing the wheels onto the landing gear assembly, the little wheel retainers (EZ connector clips) pretty much just refused to go on until I sharpened the ends of the axle wire. Then the wire pressed through and made a very tight fit that should hold the wheels in place very well.

The kits comes with some strong, white string for the rigging wires, but I didn't like the white appearance. I turned to my "string drawer" and traded in the white material for some heavy-duty, black sewing thread. I think it looks a lot better than white, and despite the obvious concessions made to the model's scale effect, it's still a good looking (perhaps "cute" is a better word) model in the air and when sitting on a desk. Since it requires calm air (or an indoor flying site) for best performance, and calm air is not a common event here, my little SE5a will spend most of its time right beside my E-flite JN-4 Jenny, hanging from the ceiling in my work shop. But it will be a welcome addition there, for I like the old bipes of this era.

When adding the rigging wires (black thread) I was unable to get the thread through the tubes in the fuselage. I tried pushing a thin wire through them to clear them out, but not even the wire would go through. I finally just ran the thread through the slots formed where the bottom wing meets the fuselage, front and rear.

Once the rigging wires are in place, the instructions say to check the wings for warps and correct them if you find any.

Huh? Say what? Correct them how? I looked, but found no advice on that, so I'm assuming they don't know how any warps would be corrected at this point either.

Anyway, after gluing the machine gun in place on the top wing, I was out of parts and out of instructions, so I guess I'm done!

Now it's time to check the CG. I had to move the little battery all the way forward, right up against the plastic cowl, but then it balanced perfectly, right at the recommended point.

With the 1.0 oz. battery fastened in place, my little SE5a weighed a whopping 236 grams, which I believe converts into 8.32 oz. (no wonder I was tired!), which in turn gives us a back-breaking wing loading of 3.78 oz./sq.ft. All of this is within the advertised specs, too.

And that, I believe, brings us to the end of the assembly portion of this review. Now it's time to take it outside and... curse the wind!

Flying the E-flite SE5a Slow Flyer

I had the little SE5a ready to fly for some time, just waiting for the right moment with totally calm air. Then one evening when Peter Young was about to leave after a visit in my workshop, I happened to mention that it was ready to fly.

"It's dead calm right now, so get it out and let's fly it.", he so kindly volunteered to fly *my* airplane in near darkness! And despite the absence of sunlight, I brought it out, connected the battery, and hand-launched it into the highly restricted airspace known as "The Front Yard" (and a lot of the Nabors' yard as well, whose name really is "Nabors", so my neighbors are the Nabors!).

Well, the little bipe flew fine, but after just one quick flight, Pete decided it was a little too dark after all. *"Let's not push our luck. Maybe we can fly it more tomorrow."* I agreed, and put the now-flown SE5a away.

I actually carried the little war bird to the air field about four times, but found it too windy on each occasion. Then, much like Pete's maiden flight, I noticed that the air was dead calm early one evening, but this time there was still plenty of daylight left. So once again I readied the model in a minute, and tossed it into the air over two adjoining front yards (mine and the Nabors'). Well, it doesn't fly as slowly as its sister-ship, the E-flite JN-4 Jenny, which has a larger (35.6") wing with more (320 sq.in.) area, and weighs only 7.5 oz. for a whisper-like wing loading of 3.38 oz./sq.in. (See review in our Sep 07 issue.) The difference isn't huge, however, and if memory serves me well, the SE5a seems a bit more frisky and aerobatic than the Jenny. Dare I say that it's faster? With either of these planes, it's hard to distinguish between a slow pass and a high-speed pass. I'm sure I heard birds laughing at me (but I may go after them later with an EDF jet!).

Unlike the E-flite Jenny with which I found no fault in-flight, my SE5a came out with a slight but noticeable warp in the top wing. It still flies fine, mind you, but anything more than the smallest change in throttle requires re-trimming the elevator and rudder. It was annoying at first, but once I got used to it, it no longer seemed to matter. I like it, and so do the kids in the neighborhood. The only problem with the kids is seeing their disappointed faces when I tell them that it takes times and patience to learn to fly R/C. Most of them want to fly it "right now", and they don't hesitate to show their disappointment when I don't give in.

I've always enjoyed ultra-slow flight, which is what led to my long-ago series of "Sig Kadet Lite's" (3-ch Sig Kadets built with 72" wings plus 3" of plastic tips, and 3.5 to 3.75 lb. weights). I still have one today (my "All Day", which is powered by an O.S. FS-26. People see that tiny engine in a 75" wing of over 800 squares, and often ask, *"Are you sure that's enough engine for this airplane?"* Their doubt vanishes when they see it take-off in 20 feet and do endless loops in the air.

I've no experience flying indoors, however, since we so rarely have access to a suitable facility. I've had my E-flite Jenny Slow Flyer for over a year now, yet I think I've flown it only about a dozen times, and so far only over two adjoining front yards. But the Jenny pleases me just being up there on the ceiling of my workshop, and I suspect the SE5a will soon join it, seldom to be flown, perhaps, but ready to go at a moment's notice when the air is dead calm.

-Gordon Banks
glbanks@knology.net

FUN AEROBATICS

by Ed Moorman

We're back! We're back! It's online now, but we're back! Man, I was having withdrawal symptoms from not writing a column, so my sincere thanks to Tony Coberly for taking us online.

MANEUVER OF THE MONTH
INVERTED FLIGHT
Description

This month we're going to take another look at flying inverted, which is simply as it sounds, flying our airplane upside down. Oh, and on purpose, of course. The trick is that the elevator function is reversed, so we have to push the stick forward to climb. Our normal up-elevator is to pull back, which causes a dive while flying inverted. Much like outside loops, inside-outside 8's, and other outside maneuvers, inverted flight has a certain "fear factor" about it, especially for inexperienced fliers. Flying with the elevator control reversed is different (and a little bit scary), but if you follow the steps, you'll be doing it in no time!

Before we go any further, I want to talk a little about learning. As you have probably noticed by this stage, learning to fly and later learning aerobatics is not all that hard, but it does take patience and practice. You have to fly, fly, fly, and progress at your own speed. Don't try to rush through learning anything. If you're having trouble, ask a buddy to go over the maneuver card with you to see if he can see spot whatever you're missing. You can also ask others how *they* do the maneuver. Remember, there is no "one way" to do every maneuver. I break them down into easy to learn steps so you can hopefully teach yourself. If you still can't get it, though, send me an email and I'll do my best to answer your questions.

All right? Now let's get back to learning inverted flight.

KEYS TO INVERTED FLIGHT

I think the key to learning to fly inverted is to get over the fear and stress of doing something different. Let's face it, doing loops, rolls and such is really not stressful. When you first start trying to fly inverted, you'll probably notice a little fear. After all, just one wrong move, if you aren't high enough, may mean bashing your plane. *(Editor's Note: And this differs from normal flight, how...?)* You need practice to overcome the psychological barrier of using down-elevator to climb. "Down" is usually perceived as "wrong" when you're a novice because it means heading toward

R/C Report Magazine	
TEACH YOURSELF AEROBATICS CARD	INVERTED FLYING By Ed Moorman
DESCRIPTION OF INVERTED FLIGHT: Flying with your plane upside down where down is up and up can be bad.	
KEYS TO DOING INVERTED FLIGHT	
Overcoming the fear and stress of something different.	
PLANES FOR INVERTED FLYING	
1. BEST OVERALL FOR INVERTED FLIGHT: Any LOW-WING AEROBATIC PLANE. These planes will fly inverted with ease.	
2. BEST TO START WITH: an easy flying plane with a SYMMETRICAL or semi-symmetrical airfoil. STICKS or 4-Stars are good.	
3. HARD TO FLY INVERTED: HIGH WING PLANES with FLAT BOTTOM AIRFOILS and a lot of DIHEDRAL. May require nearly full down elevator to hold level. Will tend to roll out and get back upright.	
4. HARDEST TO FLY INVERTED: 2 and 3 channel rudder only planes & sailplanes.	
CONTROLS IN INVERTED FLIGHT	
ELEVATOR IS REVERSED. Everyone knows this.	
RUDDER IS REVERSED! Lay your plane upside down in a cradle & try it. Put in right aileron and notice it takes LEFT rudder to coordinate.	
AILERON IS NORMAL, just the same as upright. Banking is exactly like when you are upright.	
THINGS TO WATCH OUT FOR	
CAUTION: A trainer type plane that tends to roll out of banks by itself, when inverted will now try to INCREASE THE BANK. Watch out for this in inverted turns	
CAUTION: Generally, planes with stabilizers mounted low on the fuselage are MORE SENSITIVE IN THE DOWN DIRECTION. Planes with high mounted stabs are more sensitive in the UP direction. This can affect the amount of control input you need.	
CAUTION: Check your elevator movement. You may have less down elevator than up. If so, you might not have enough to hold level flight inverted on some planes.	
CAUTION: We tend to watch the "high" wing of a plane in a bank. We use this "picture" to set the bank angle. This sighting on the high wing panel puts the bank angle lower than we think it is. In an inverted turn, the sighting in on the higher wing makes the bank angle HIGHER that we think it is. This can cause you to overbank and get in a downward spiral. Be aware and be prepared to bail out and recover.	

the ground. "Up" elevator is the good elevator control, because it so often saves our plane. You learned this early. When you got in trouble, especially while at low altitude, you added power and up-elevator to save the plane, right? Inverted flight is like so many other maneuvers, though, in that you simply need to practice it enough to get comfortable with it.

AIRPLANE SET-UP

Bear in mind that some planes simply won't do all the aerobatic maneuvers, or at least it may not do them well. What's the best plane for flying inverted? This is mostly determined by the airfoil. A symmetrical airfoil is the same inverted or upright; so that's the best way to go. Semi-symmetrical airfoils like that used on the Sig 4-Star models and many others are often so nearly symmetrical you can hardly tell the difference between then and a full symmetrical airfoil. Your outside loops won't be as tight, but unless you're doing timed loops in a fun fly contest, it really doesn't matter. Another thing to consider is the wing location and any dihedral. If a plane is set for good knife edge (i.e., no roll coupling), it will be easy and stable while inverted, and also easy to fly when you get to inverted turns.

The best plane for inverted is a low or mid wing aerobatic plane. These generally have symmetrical airfoils, so they really don't care which side is up. These planes also usually have their dihedral angle set so that roll coupling has been canceled, so the stability will be the same upright or inverted. Low and mid-wing aerobatic planes will usually fly inverted with ease as long as you care to do so.

Do you remember our discussions about high wing planes with anhedral? Turn your low wing plane upside down and look at it. What do you have now? That's right, a high wing plane with anhedral.

FLYING INVERTED
1. STANDARD SETUP: 1. Full power, 2. Parallel to the runway, 3. One good mistake high. The maneuver may be started either flying up or down wind.
2. RAISE NOSE about 20 degrees & release elevator. We want the nose high to start with since it drops as we roll over and we don't want to start flying inverted in a dive.
3. ROLL INVERTED & release aileron. Start before you pass in front of yourself to give some time before recovering.
4. DOWN ELEVATOR to hold level flight. Hold until past your position.
5. Release the elevator and ROLL UPRIGHT. If you get confused, use UP elevator to "Split-S" out. This is the reason for flying high.
6. Practice until you get the feel for the right amount of down elevator, you can maintain level flight inverted fairly well and you can roll back to upright flight. When you can do this, go to inverted turns
INVERTED TURNS
REMEMBER: While inverted, the ELEVATOR IS REVERSED, but THE ROLL CONTROL IS THE SAME AS UPRIGHT FLIGHT
1. STANDARD SETUP: ONE-TWO MISTAKES HIGH
2. ROLL INVERTED. Put in down elevator to stay level
3. Roll into a shallow to MEDIUM BANK and use down to hold level in turn. In upright flight, you have the plane trimmed for level, so you can roll into a bank with the elevator neutral. In inverted flight, you are holding some down elevator to stay level and you must continue to hold this down while rolling in
EXPECT TO USE A LOT OF DOWN. You are adding down for the turn to the down that you were already holding for inverted level flight. Don't be timid.
EXPECT TO OVER BANK. Remember what I said about the visual cues and dihedral.
If you get into a DOWNWARD SPIRAL, you have a combination of too much bank and too little down. Bail out & try again.
An upward spiral is caused by too little bank and too much down.
4. To roll out, release most, but not all, of the down elevator, and use opposite aileron. Remember, you have to hold some down to stay level inverted, so you can't release all of the down when you roll out.
5. Stay 1-2 mistakes high until you are comfortable
CLIP OUT, LAMINATE & TAKE TO THE FIELD *COLLECT THE WHOLE R/C REPORT SERIES*
Ed Moorman E-mail: moorman1@cox.net

The next best types are the "Stick" type planes and other high or shoulder wing planes with symmetrical or nearly symmetrical airfoils. They have the airfoil for flying inverted, but the high wing location with dihedral makes them tend to roll out of inverted all by themselves. They won't trim for cruising around inverted as well as they do when upright. They're still good second-airplanes, though, and good to learn inverted flying with, especially if you aren't doing a lot of inverted turns.

Trainers and high wing planes with flat bottom airfoils and a lot of dihedral are best for learning to fly upright, but they are among the very worst for learning to fly inverted. These trainer and scale type aircraft were designed to have positive stability, and to actually resist flying any way but upright, straight, and level. They may require close to full down-elevator to hold level while inverted, and they will always try to roll out and get back to upright. The silver lining to this is that once you can do inverted flight well with such a model, it will be a piece of cake with a more suitable design.

And of course, the planes that are *really* hard to fly inverted are the 2-ch and 3-ch "rudder only" airplanes and sailplanes. Like trainers, these model types simply weren't designed with inverted flight in mind!

INVERTED FLIGHT CONTROLS
Reversed Elevator

While flying inverted, down-elevator is up-elevator, and vice-versa. But you probably knew this already.

Reversed Rudder

Oh, you *didn't* know this? Well it's true. To see this for yourself, place your model upside down in a fuselage cradle, and check it out. Apply the rudder and note that its direction of movement is now in the opposite direction.

Normal Aileron

Yes, the aileron function remains the same while inverted. Many people get confused and think *everything* is reversed, but roll-steering the plane is the same, upright or inverted. Here again, you can see this for yourself with the plane inverted in a fuselage cradle.

3-CHANNEL PLANES

Now before you even ask, what if you have only a 3-ch plane? Remember, a 3-ch model uses rudder for roll control, but it gets that roll due to yaw from the wing location, usually a high wing, and from the dihedral, which is typically very generous in a rudder-only design.

In an earlier column we discussed how a high wing with dihedral causes roll in the direction of the rudder. Right rudder causes a right roll, left rudder causes a left roll. This works regardless of your plane's position, upright or inverted, so a 3-ch plane will still steer just fine while inverted.

DIHEDRAL AND INVERTED FLIGHT

Here's another thing about our controls and steering while inverted. When a plane with dihedral is inverted, the dihedral becomes anhedral. A plane like a trainer that used to roll out of banks on its own, will now try to increase the bank angle all by itself while inverted. Watch for this in inverted turns.

ELEVATOR SENSITIVITY

Given equal elevator movement, high and shoulder wing planes with stabilizers mounted low on the fuselage are usually *more sensitive in the down direction*. While flying a Stick model inverted, you may notice that the elevator control is more sensitive, and outside loops are tighter than inside loops.

Low wing planes with a high mounted stab, on the other hand, tend to be *more sensitive in the up direction*. This can affect the amount of control input you need, so check your elevator movement, before you start flying inverted, and set it for equal up and down in the beginning. This is especially true for a low wing plane since there's a tendency to set in less down elevator movement than up.

A high stab means a more sensitive elevator in the "up" direction. A low stab means a more sensitive elevator in the "down" direction.

USING DOWN ELEVATOR

There's a natural reluctance to use down elevator. Remember, your subconscious probably still thinks of down elevator as "bad." People simply don't like to apply a lot of down-elevator. It just doesn't seem natural at first. Also, since your plane is trimmed for upright flight, you'll usually have to apply a bit of down-elevator just to maintain level flight while inverted. This is totally normal, and the amount of down-elevator needed will vary from plane to plane.

FLYING INVERTED

Standard Setup

1. Use full power
2. Fly parallel to the runway
3. Fly one or two mistakes high

Inverted flight can may be initiated while flying up or down wind.

What To Do

1. Fly parallel to the runway and just before you pass by in front of yourself, raise the nose about 20° and then release the elevator. You want the nose a little high to start with, since it drops during the roll-over, and you don't want to begin your inverted flight in a dive.

2. Roll into inverted flight and then release the aileron. Do this *before* you pass by in front of yourself to allow some inverted flight time before you begin to recover.

3. Hold just enough down-elevator to maintain level flight. Don't jam it in! Watch the plane and use just enough to keep the plane level. And try to remember how much you needed so you'll be better prepared next time.

4. When you run out of time or distance, release the down-elevator and roll back upright. In a panic situation, go ahead and use up-elevator to "Split-S" back to upright flight. That's why we started out one or two mistakes high, remember? But be careful that you don't overstress your wing. If you can remember to do so, cutting the throttle back to idle power will reduce the stress during a panic pull-out.

Practice inverted flight in both directions until you get the feel for just the right amount of down elevator needed to maintain level flight. When you can do this well, and you can roll back to upright flight without panic, then we'll move on to making inverted turns.

INVERTED TURNS

Everyone learning to fly inverted is reluctant at first to use enough down elevator. This is especially true when you first try inverted turns. What you don't realize is that you use nearly full up to make a fairly steep upright turn, so you'll more than likely have to use nearly full down when you make steeply banked inverted turns.

Here's another thing: I've found that nearly everyone watches the higher wing panel of their plane in a bank. In other words, in a left banking turn the right wing panel is the higher one as we look at the plane. This is the one we use to "set" the bank. We use this mental picture to set our bank angle. For a plane with dihedral in upright turns, this "sighting in on the higher wing panel" puts the bank angle a little lower than we think it is. Conversely, in an inverted turn, sighting in on the higher wing makes the bank angle *higher* than it might appear. This, coupled with the natural reluctance to use down-elevator in the first place, tends to cause people learning to fly inverted to get into a downward spiral. Be aware of this and be prepared to bail out and recover to upright flight.

Now I know some of you are going to say that you use the whole airplane to set your bank angle, but fly inverted and then roll into a bank and see if you don't tend to set the bank angle using the upper wing panel. It's the natural way.

Now remember, while flying inverted the elevator function is reversed, but the aileron function remains the same as it is during normal, upright flight.

MAKING AN INVERTED TURN

1. Set up and roll into inverted flight just like you've been practicing. After passing yourself, start the turn. You want to be far enough away to see the top of the plane when it's banked, but not so far away that the plane is hard to see.

2. Use only a small amount of aileron to roll into a shallow bank, and use down-elevator to hold the plane level in the turn. Use only a small amount of aileron, so you don't release the elevator during the roll in.

USE A LOT OF DOWN

You're adding more down-elevator for the turn, to the amount of down-elevator you were already holding just to keep the model in level flight. Don't be timid here, the plane should be high enough to bail out of any position you get into, so stop being afraid of using down-elevator.

EXPECT TO OVER-BANK

Remember what I said about the visual cues and dihedral? If you get into a downward spiral, you have a combination of too much bank and too little down. Bail out and try again.

An *upward* spiral, on the other hand, is caused by too little bank and too much down.

To level the wings after the turn (but still inverted), use opposite aileron and adjust the down-elevator to hold the nose up and level. Remember, you were holding some down-elevator just to stay level while inverted, so you can't release all the down-elevator when you roll back to inverted level after the turn.

Try to stay at least one or two mistakes high until you are comfortable and confident in this.

SUMMARY

1. Start with the Standard Setup
2. Raise nose before rolling into inverted flight
3. Practice flying straight inverted first. Roll in, fly level, and roll out
4. It takes a lot of down for an inverted turn
5. Watch out for over-banking
6. Elevator function is reversed while inverted, but the aileron function is not.

Good inverted flight comes mostly from practice, which leads to confidence and less discomfort. Once the model is inverted, you're just flying. The elevator function is different (reversed), but while inverted the ailerons work the same. Stay high at first and get lots of practice. Practice and familiarity are all you need.

FEATURE OF THE MONTH

Seaplanes

Our first float fly of the year was held on March 7. As usual during the first float fly each year, most of us had troubles of some sort, ranging from minor to major, and several repairs will be necessary before the next one.

I test flew a new Rascal 40 ARF on floats. It's an excellent airplane and a great kit! The only thing I don't like about Rascals is the inverted engine. It's okay on land, of course, but on water it's just not for me. I have not had a lot of luck with engines idling well when installed inverted, so I changed the engine position. The plane comes with wooden beam mounts and a balsa cowl. I lopped off the beams with a band saw, and then used a Great Planes adjustable motor mount to install an O.S..FS-70 Surpass. I was going for a side mount; but I couldn't get the fuel tank high enough due to some bulkheads, so I settled for a

Photo 1

Photo 2

Photo 3

45° angle down mount. It ran just fine like that. The cowl is a Cub cowl from Fiberglass Specialties.

Photo 1 shows Mark Pfeiffer's electric Great Planes Electrifly SeaWind EP. This is a *great* flying little plane, just as Gordon and Tony reported in their kit review (Nov 07 issue). Mark also has the big, glow powered SeaWind (reviewed in our Sep 06 issue), and he says the electric one flies better!

Photo 2: Jim Giffard's O.S. .55AX powered UltraStick 40 makes a climbing turn after liftoff. Note the float spacing. Most Sticks make great seaplanes.

Photo 3: Here we see Joe Shearer's Kadet Senior on floats. Joe has flown this plane since we started flying at this lake back in 2003. The rest of us go through several planes every year, but Joe's 4C powered Kadet is so steady and reliable, it just keeps coming back.

See y'all again next month. Until then, remember to practice, practice, and then go practice. But above all, fly safe and have fun.

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NOTE FROM THE NEW MANAGEMENT!

Please bear with us, guys. We will have one or two scale columns soon, we will have more Product Test Reports, and they won't all be electric ARF's. We're still stumbling through the initial startup and growth glitches, but improvements are just around the corner.