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MARCH 2009 ISSUE 272

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R/C REPORT

March 2009 Issue 272

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R/C REPORT MAGAZINE

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SMILEY FACE HUNTERS

There's no more contest, of course, but we hid 10 Smiley Faces in this issue anyway for those who want to strain their eyes for nothing. A list of their locations is hidden as well!

lines from the editor

Note: Tony has allowed me to revise a few pages before posting the March issue online. Since my editorial in the printed March issue dealt with the magazine going out of business, and the online version is just getting started, I didn't think it appropriate to begin on such a negative tone. I've also revised the back issues list to more accurately reflect the current status of the available supply, and the two pages of classified ads have been edited to remove the items that we know for sure have been sold.

Needless to say, it's been an interesting and very busy time for me since the printed March issue was mailed. Closing a business sure is a lot more complicated than I thought, and although I should have anticipated it, the man-hours involved have been staggering! More on that later. Also, so many wonderful people have expressed their kind concern about the current welfare of Mina and myself, I wanted to update you on that.

First of all, since the magazine's remaining assets fell far short of being sufficient to send refunds to every applicable subscriber, I was naturally very concerned about our financial situation. Well, I am very proud and happy to report that due to so many generous subscribers, Mina and I are going to be fine. I'm only guessing at the number, but it sure seems like about half of the subscribers due refunds of over $10 have yet to request them, and a truly surprising number have called or written to decline their refund. What's more, nearly two dozen people have actually sent donations to help (cash, checks, one Wal-Mart gift card, and two Pizza Hut gift cards)! Although I've declined cash gifts in the past, I've pretty much had to accept them this time, and I can't tell you how much they're appreciated. As I wrote in my printed March issue editorial, the people are the best (and worst) part of this great hobby (and Tom Mekis, of Fenelton, PA, must be one of our rare R/C Saints!).

Yes, there have been a few nasties involved in the refunds, but if you read the printed March issue, you may recall that I begged anyone due a refund of less than $10 to please forgive us that small amount. Well, so far only one person requested a $9.00 refund, so I sent it. I'm assuming that he needs it even worse than we do.

There have been two instances even more disappointing, however.

Two people not only requested a refund check, they also asked their credit card companies for a refund. I could be wrong, but it sure seems like they found a way to get double their money back. Furthermore, there's a $20 fee for credit card charge-backs, so these guys hurt us deeply. I've written to each asking them to return or refund the checks I sent them, but neither has responded (and both checks have already cleared our bank). Modelers in general are great people, but as in any group, there are those few exceptions.

Nevertheless, the number of good stories (refund forgiveness and outright donations) is far greater. So, in response to the many letters of concern, I'm more confident than ever now that Mina and I are going to come through this alright. Tony Coberly, by the way, my new boss at RC REPORT Online, has also been generous and helpful by giving me a job! My efforts to find full-time employment have faded from a full-on assault at the end of January, to just making a few phone calls a week by mid-March. My best results so far have been just two phone interviews, both of which died almost immediately after the caller learned that I was over 60 years old.

Anyway, due to the kindness of so many readers, my worries about our personal finances have subsided, but in my tunnel-vision worry about money, I overlooked something else. Have you any idea how long it takes to write thousands and thousands of checks? I somehow overlooked that part of the refund process. Had I thought of it sooner I would have invested in some sort of computer generated checks. A typical refund goes like this: I get a SASE (self-addressed stamped envelope) and refund request from Joe Modeler. First I look him up in the subscription database, determine the value of each unpaid issue based on how many years he ordered the last time he subscribed or renewed, and then calculate the number of remaining issues. From that I compute the amount of his refund, and then enter that amount along with the date and check number in the computer. Then I turn to the checkbook and fill out the check, stick it in his SASE, and then examine his refund request again to see if anything else is required (free stickers, article reprints, personal questions, etc.). In most cases, the whole process takes at least four minutes each, so I can do no more than about 15 an hour. Working 12 hours a day doing nothing else, I can thus send out sometimes 180 checks a day. I'm making pretty good headway, and the new arrivals have dwindled to no more than 10-12 a day, so I'm hoping to be done with it by the end of April. (When I'm not writing checks, I hang my right arm in a sling! Talk about writer's cramp!)

Oh yeah... now might be a good time to mention the handful of people who sent refund requests without including a SASE. Guys, I know you shouldn't have to send a SASE to get your own money back. I totally agree with that. But I'm asking you to do so anyway because I need your help, both with postage, envelopes, and time. And since the vast majority of people have graciously cooperated, the few that have not cooperated are being ignored. As explained earlier, it takes a lot of time to process these refund checks, so I don't think I'm asking too much. Like so many people have rightfully pointed out, how many other magazines made any refunds at all when they went out of business? I didn't lose anything to *"Model Shopper"* or *"Scale R/C Modeler"* since I didn't read either one. But I had subscriptions to *"Model Builder"* and *"R/C Modeler"* when they went under, and I never received a refund. I don't know anyone who did.

So, to be quite frank about it, if someone doesn't care enough about their refund to provide the self-addressed stamped envelope, then we don't care enough either.

Other notable examples of refund kindness:

"Send me half and spend the other half at Pizza Hut. I'd like to buy you lunch."

"Please send a refund only if it comes from company assets. If it has to come from your own pocket, then don't send me anything."

"It doesn't seem fair that someone who's honest enough to send refunds goes broke, while companies who don't send refunds get to keep the money. I don't want to be a part of that, so keep my refund and give it to the (expletive deleted) who demand it."

Some amusing anecdotes:

Many people calculated the amount of their refund, but some misinterpret the meaning of their expiration date. For example, a request might include a note that his expiration date was 1209, meaning the December issue of 2009, so he's expecting a 9-issue refund of $11.97 to $14.22. Well, thanks for playing the game, but no. An expiration date of 1209 actually means the 9th month of the year 2012, so that refund check was for 39 issues ($51.87).

Three people so far returned their refund check with similar notes: "Now that I see you really meant it when you offered to send me a refund, I want you to have it back with my compliments."

Speaking of advertising, I've been asked many times how much pressure we get from advertisers to publish only favorable reviews of their products, and/or how much backlash there is when we publish an unfavorable review. I learned early from a few "ex-editors" that many magazines publish guaranteed favorable reviews in exchange for ad contracts. Some only publish reviews of their advertiser's products. I don't mean just in the modeling industry, either.

Several companies called and openly offered lucrative advertising contracts in exchange for favorable reviews. Others wanted the right to see and edit our reviews of their products before they were published. We declined all such offers. And yes, a few companies pulled their advertising immediately after we published a review they didn't like (often refusing to pay their existing ad bills, too!). But once the word spread that *"R/C REPORT"* couldn't be bought, that sort of thing became increasingly rare, to the point where I can't even remember the last time it happened.

Many readers think that the giants in our industry are the most likely to do this, since they have the most to lose, plus they buy more ads. So now that "*RCR*" is closing, and therefor have nothing to lose by telling *"The truth, the whole truth, and nothing but the truth"*, I'm going to tell you what I *really* think of Hobbico (which includes Carl Goldberg, Dynaflite, Electrifly, Fly Zone, Fuji, Futaba, Great Planes, O.S., Supertigre, Top Flite, Tower Hobbies, and more) and Horizon Hobby (E-flite, Evolution engines, JR radios, Hobby Zone, Park Zone, Saito engines, Spektrum radios, Zenoah engines, and more).

THEY'VE BOTH BEEN GREAT!

Actually, Hobbico did complain once. It's easy to remember because it only happened once! On the cover of our January 2003 issue (#198) I used a reader-submitted photo of a pretty lady holding a .40 size Great Planes RV-4. I chose that photo because it was far more "cover suitable" than any photos that accompanied a kit review in that same issue of a Katana Aircraft Models .20 size RV-4. That would have been okay had the cover layout not inadvertently tied the photo to the text about the Katana kit review. Great Planes complained that the cover made it look like the photo of their model was the Katana kit, and they were right. I learned from that mistake, they accepted my apology, and all was forgotten.

And that, ladies and gentlemen (and you too, Bob and Don), was the one and *only* time that *either* of the two "giants" of our industry

Photo 1: My "Tiger 90 Stick" came from a 1986/7 vintage Modeltech ARC "Joss Stick" kit. Completed and ready to fly at last, it sports an equally old Supertigre S90K engine, but a new Spektrum flight pack commanded by a Futaba 10C radio with a Spektrum RF module. I used a hokey ol' wooden prop for engine testing at home, but it will fly with an APC 14x6 when the time comes.

years, and has been extremely helpful. He may not be going with me next time, though, or anywhere else for that matter. Tony doesn't like the way I travel. See, I believe in efficiency, and within that belief is my conviction that one should not stop and fill the gas tank any more often than necessary. It takes time and gas to exit the interstate, drive to a gas station, then drive back to the interstate, and accelerate back to cruising speed. I therefor do it as seldom as possible, stretching the range of each tankful as far as I can. Tony, on the other hand, thinks one should stop for gas before the fuel gauge needle is resting on "E". He thinks the 1/4 full mark means "get gas soon", and that the flashing yellow warning light means "get gas now". So when I twice stopped for gas and pumped about 19.7 gallons into my car's 20 gallon tank, he called it sheer luck, and muttered something about riding with someone else next year. Maybe he just has weak kidneys and doesn't want to admit it.

Getting back to my models, I've been busy writing refund checks, calling overdue advertisers, and seeking a full time job, but I sneak out to the work shop every now and then too. As you may already know, I like to work at night and into the early morning hours when it's fun to call Tony and ask what he's doing. I have a very special scratch-build project in mind for the future, but I've not built anything but ARF's and RTF's in several years now, so I'm easing back into model building gradually. Wondering if I still knew how to apply an iron-on covering, I dug out two old Modeltech ARC (Almost Ready to Cover) kits that we bought from World Engines back in 1986 or 87, but never got around to reviewing. I've already completed the "Joss Stick" (see **Photo 1**), a 1.20 size Stick model on which I fastened my ol' reliable Supertigre .90. I didn't use the Stick-type wing tips,

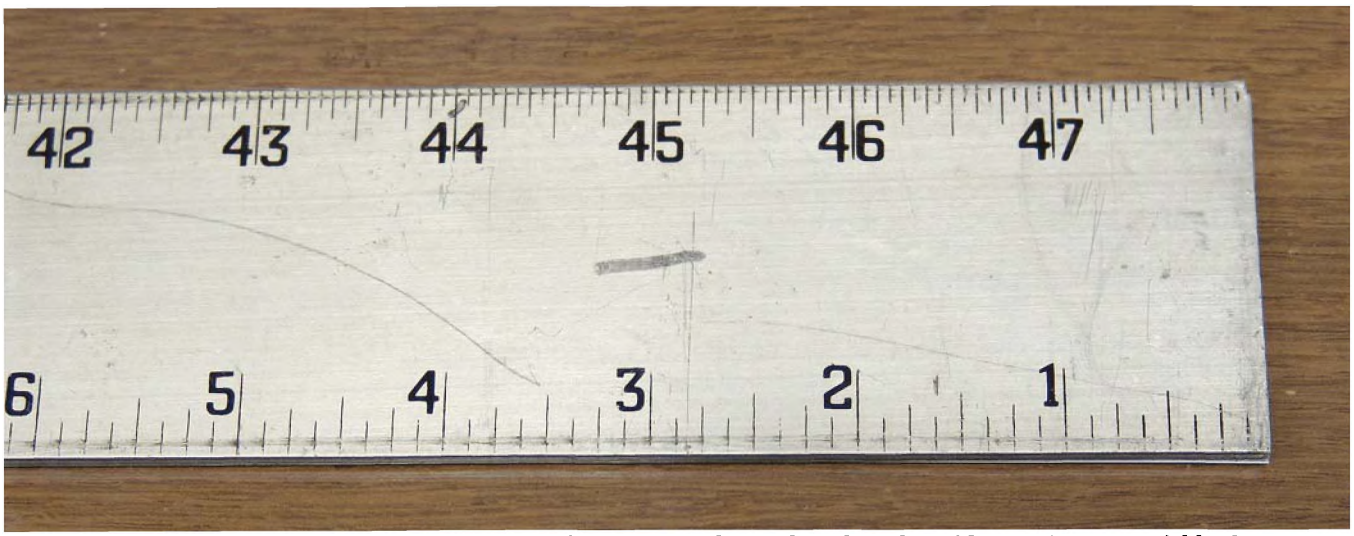

Photo 2: My 48" measuring stick came with these markings, but the other side was (past tense) blank.

so the 61.4" wing hosts 816 sq. in., supporting 8.5 lbs., for a wing loading of just 24 oz./sq.ft. I'll use my Futaba 10C radio to control the Spektrum AR7000 receiver and five DS821 digital servos (2-ail, 2-ele, 1-rud) with an old NES537 on the throttle, all powered by 4-cell 1100 mah NiCd battery. We published a review of the ARF Joss Stick in our May 2001 issue.

My ol' Supertigre S90K engine hadn't been run in many years, so it was gummed up tight as a banker being asked for a home loan. I squirted some ATF (automatic transmission fluid) into the cylinder and down through the carb, and then thoroughly heated it with a heat gun to soften the gum. Soon it was turning over nice and smooth, and it later started on the second flip of the prop! Sometimes it's better to be lucky than good.

After one long evening of assembly and sanding, I spent 16 hours covering the entire model in orange UltraCote. Then I spent four more hours adding the rippling, black stripes to the upper surfaces. This, along with the engine and some Supertigre stickers, gave birth to the name "Tiger 90 Stick".

Slipping out to the work shop for an hour or two is one thing, but breaking loose for several hours to go flying is another, so it hasn't flown yet. But I'm sure it's going to fly well. It's almost the same airplane as the Modeltech "Dragon Lady" that I assembled and flew many years ago for a review in our March 1987 issue, and the Dragon Lady flew great.

YOUR WHOLE NINE YARDS
(may be only 323-3/4")

Guess what! I recently discovered that my primary yard stick is inaccurate! Its 36" length is only 1/16" short, but still, it's wrong! And even worse, the inaccuracy is not evenly spread! Some of the inch markings are correct, while others are up to 1/64" off! And then while cleaning it with alcohol, the markings began to rub off! In case you're interested, it's an aluminum stick made by Macklanburg-Duncan, of Oklahoma City, OK.

This led me to check all of my yardsticks and rulers. Thankfully, my 48" aluminum stick, from Empire Level Mfg. Corp., of Milwaukee, WI, appears correct from end to end, and I measured every inch of it, too. You might want to check yours before using it again.

Now, I can already hear some of you wondering aloud, or asking yourself, "Self, how the heck are we supposed to know just how long a true'inch' really is? When checking our measuring devices for accuracy, what do we use as our calibration standard?" Good question, but not one that I want to answer, because I don't really know. I feel safe with my conclusions, however, because the majority of my measuring sticks and tapes agree with my two digital calipers (calipers, not micrometers, okay?).

The next question I want you to ask is, "How did you discover the inaccuracy?" Good question! Thank you! And since you insist, I'll go right ahead and tell you.

For me, the ideal measuring stick for modeling, regardless of length, is one I've dreamed about, but have never been able to find. I want one that measures left to right on both edges of one face, and right to left on both edges of the other face. And the markings should be so permanent that alcohol and model fuel won't wash them off. The 48" stick I mentioned earlier is about half-way there, with indelible markings on one face reading left to right on the upper edge, and right to left on the lower (see **Photo 2**). The backside, however, is... or was, blank.

Since I couldn't find my ideal measuring stick, I decided to make my own, using stick-on ruled metal tapes made for table-type power

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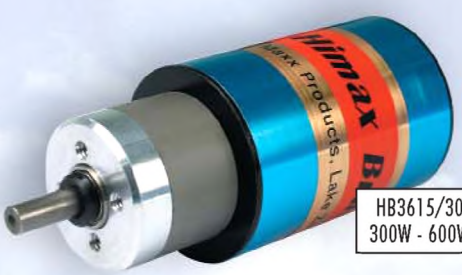
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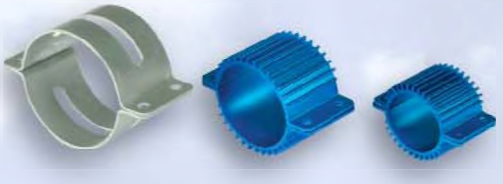

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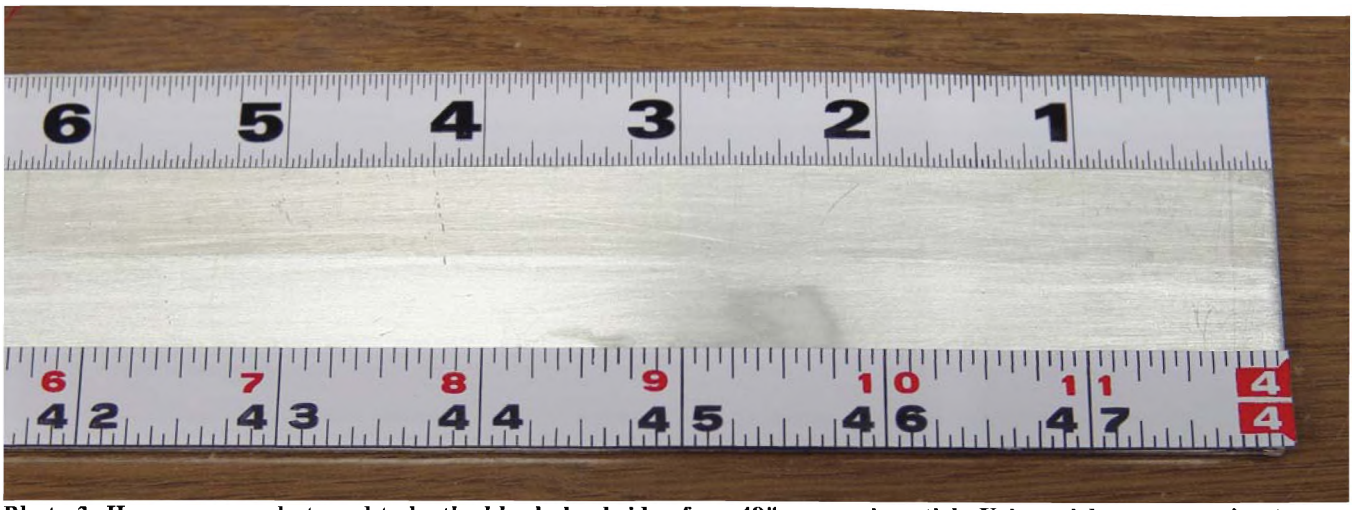


Photo 3: Here you see what used to be the blank, backside of my 48" measuring stick. Using stick-on measuring tapes, however, I converted the useless blank side into a useful tool.

tools that make large pieces of wood smaller. I thought about using the tapes from inexpensive cannister-type measuring tapes, but they're curled to give them stiffness when extended, so they don't lie flat on the surface of a measuring stick. The 0.5" wide tapes I used are not only thin (0.016") and flat, they already have a very tenacious adhesive on their backside. Made by Kreg Tool Co., of Huxley, IA, they're available in several different lengths and both read directions (left to right and right to left). Kreg offers some other interesting stuff too. You can see more at www.kregtool.com. I learned of these tapes and got two packages from my brother who's an avid wood working enthusiast. I was unable to find them in any hardware stores or home improvement centers, so ordering them directly from Kreg is the only way I know. I've since learned that another company or two make similar products, so look around to find what you want. You can call them at (515) 597-6400, or see www.kregtool.com.

Anyway, using these stick-on tapes, I now have nearly ideal 36" and 48" measuring sticks (see **Photo 3**). I'm so happy now, it's almost... uh... immeasurable.

NEW HITEC RADIO

Due in August 2009 is Hitec's new and most powerful radio ever, the "Aurora 9" with sophisticated

The Hitec Spectra 2.4 GHz RF module will allow the new Aurora 9, as well as the existing Hitec transmitters using a removable RF module, to enjoy the new power and security of spread spectrum technology. Due in June 2009.

The new Optima 7 (2.4 GHz) receiver is due in June 2009 as well, to be followed later in the year by new Optima 6-ch and Optima 9-ch receivers.

programming power for airplanes, sailplanes, and helicopters. Features include a backlit touchscreen, assignable switches, a 30 model memory, and much, much more. What's more, it's an RF-module based transmitter that promises to be fully compatible with Hitec's existing FM (PPM and PCM) RF modules, and their coming RF modules incorporating 2.4 GHz frequency-hopping spread spectrum technology. In fact, the new 2.4 GHz RF modules and a new 7-ch receiver are due in June 2009, with 6-ch and 9-ch receivers to follow. Stay tuned for more aa additional details become available.

ONE TRILLION DOLLARS

There's been a lot of talk lately about the government giving big businesses well over a trillion dollars. It's been said so many times now, the word "trillion" doesn't sound so shocking any more. But just how much money is that, in folding currency that we might carry in our pocket? Well, thanks to the helpful illustrations in an email from a friend, I now have a better idea, so I thought I'd share this with you as well.

First let's look at a simple $100 bill, which most of us have seen, I'm sure. It's now the largest denomination currency in use by the general public.

Next is a standard stack of 100 bills, which is $10,000, a size we could easily stuff into our pocket.

A hundred of these 100 bill packs is a cool $1,000,000, but its actual size is not as impressive as one might have guessed. As you can see by the size of the man standing beside it, we could carry this amount in a grocery bag or a small suitcase.

One hundred of these stacks is, of course, $100,000,000, and is now a bit more than one man can carry, but note that it fits neatly onto a standard size loading pallet. You could put this into the back of a standard size SUV. (Use mine, if you like.)

$100,000,000 in cash fills a standard size loading pellet, but could be placed into the back of standard size SUV.

Sorry, folks, but it looks like the family SUV is too small to haul around one billion dollars in cash. Better get a moving van or bigger. Note how the man got smaller so we could fit all ten pallets into the picture?

Next is a much more impressive figure., a *billion* dollars. This fills *ten* loading pallets, and sadly, no longer fits into a family vehicle. Now we'll need a moving van at the very least. But I'll get one if necessary!

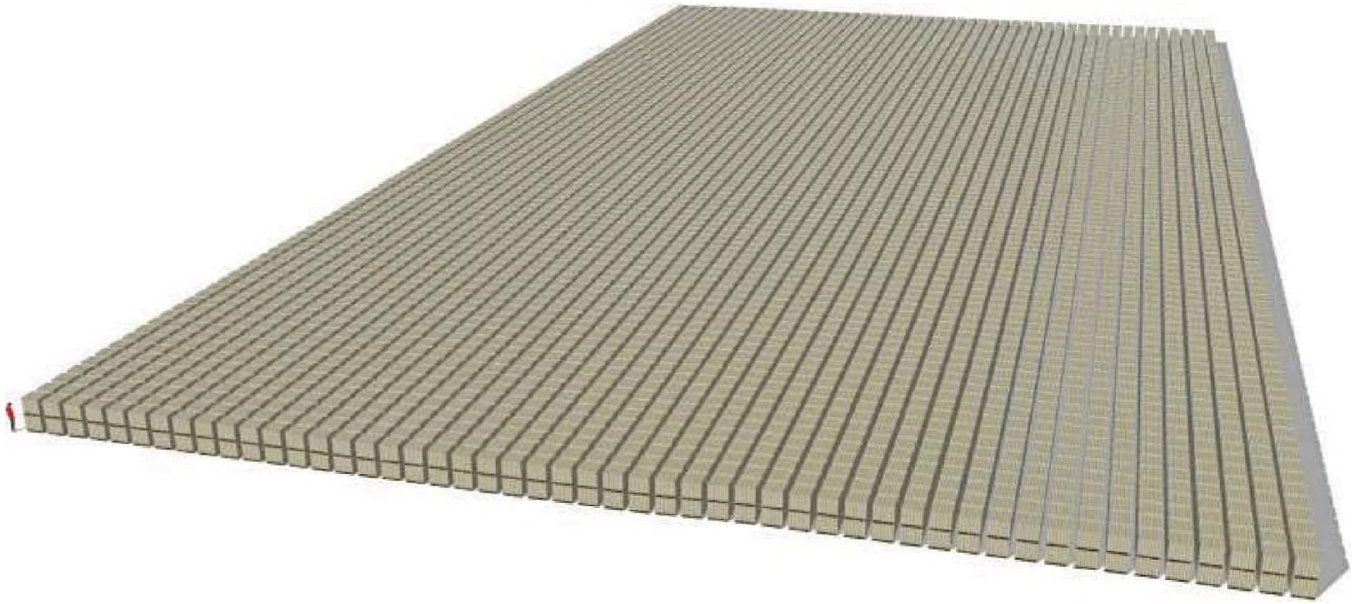
Now wait... if a billion dollars is 1,000 million dollars, and a trillion dollars is 1,000 billion dollars, then that's a *million* stacks of $1,000,000! For that we'll need more than a truck. I think we're going to need a few *trains!*

Dear Gordon,

I hope you can help me here. Last Saturday I took my model to the flying field for a full day of flying, but when I range checked the radio, the range was too short! Rather than take a chance, I packed up and went home early to investigate. When I got there, I found my wife hugging and kissing another man! We've been married 25 years now, so what should I do?

Alarmed in Alabama

Alarmed, I'm no expert in such matters, but in your shoes I'd send the whole system to a service center for a check-up. *-GLB*



As you marvel at size of one trillion dollars in cash, note the now tiny man at the corner, and note too that now the pallets are stacked two deep, one on top another. You're going to need a *bunch* of trucks to move this much cash.

READERS WRITE

Japanese Industrial Standard (JIS) screwdrivers.

Dear Sir,

I'm a new subscriber so this may have been covered before and I missed it. Since I've been reading *"R/C REPORT"* I've seen several mentions of "Japanese Phillips Screwdrivers." Is this a brand name, or are they different in some way from regular Phillips screwdrivers? Do I need them, and if so where can I buy some?

Eric Taylor
Chester, VA

JIS (Japanese Industrial Standard) screwdrivers are slightly different than regular Phillips screwdrivers, and the difference often leads to rounded-out screw heads and premature wear on the screwdrivers. According to a tool distributor friend of mine, JIS screwdrivers have slightly different tines and point angles. Look at them separately and you'll be hard-pressed to tell the difference. Compare them side by side, however, and you'll likely see how they differ. If you insert a regular #1 Phillips screwdriver into the servo arm screw on a Futaba or JR servo you may feel a slight, back and forth wobble because of the poor fit. But insert a #1 JIS screwdriver and you'll see a tight, wobble-free fit. The benefits of owning a set of JIS screwdrivers is a mixed bag, however, because regular Phillips screwdrivers vary so much by manufacturer, some fit different screws better (and last longer) than others. Plus, the JIS screwdrivers do not have a perfect fit in many non-JIS screws. How badly you need a set of JIS screwdrivers depends on the screwdrivers you already have, and how often you encounter JIS screws. Some people however, are entirely too emotional about tools, often making highly irrational purchases based solely on the "New Tool - Gotta Have It!" gene found in the DNA chain of many male subjects of the homo sapiens species. It's a sad and incurable illness best treated with a special form of therapy called "Buy More Tools". (I got mine at RJRCool Tools.com)

Hi Gordon,

Just wanted to pass along an item you missed in your recent review of the Park Zone Vapor. You said the included transmitter has no dual rates, but it does. Simply push the right stick in for a moment, and the red light will blink showing it to be in low rate mode.

Thanks Stuart Brierley
Hambury, NY
stuart@theflyingknights.com

Thank you, Stuart (and several others), for taking the time and trouble to write and correct this mistake. The dual rates function is explained in the instructions, but I somehow overlooked it.

Gordon,

I understand that you have already informed your readers that we sold See Temp to Dynamic Balsa, so thank you. We both know that Brian Burcar will do a good job taking care of our past patrons.

Before leaving the business, there's something I want to say to you and your readers. You have been publishing a great magazine for a long time, and the hobby has been fortunate to have you in it. You have also been a fair and honest businessman. Not one time in all the years you've been running the ads you made for us, did we have a problem. Even when we were late in paying, you continued the ad because you knew we'd pay when we could. How many magazines would do that for their small advertisers?

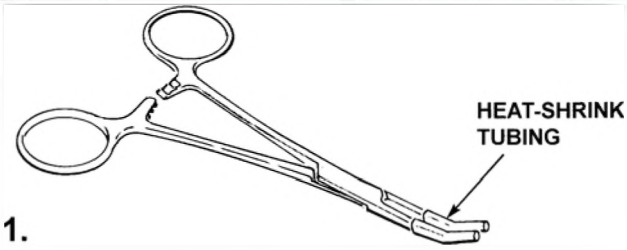
Sincerely, I hope modelers appreciate what you've been offering us in the form of the best, helpful, and most honest articles ever in hobby magazines. Thanks, Gordon, for everything.

Sincerely,

Fred & Nancy Splitstoser
former owners of See Temp
Stockbridge, WI

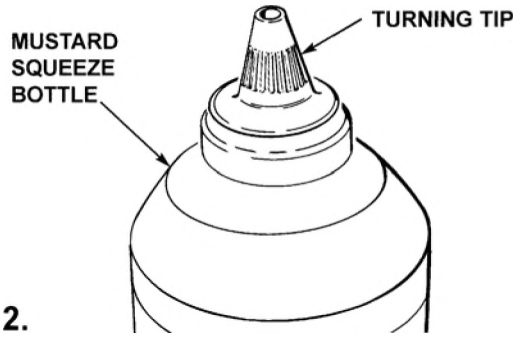
HERE'S HOW...

by Walt Wilson



1.

1. Steve Cross, of Wildwood, MO, uses medical forceps to remove and replace fuel lines when filling some of his fuel tanks. Over time, he found the teeth on the forcep jaws damaged the fuel line, sometimes causing leaks. He resolved the problem by placing heat-shrink tubing over the jaws. They still grip well, but no longer bite into the fuel line tubing. Short lengths of silicone fuel tubing would also work.

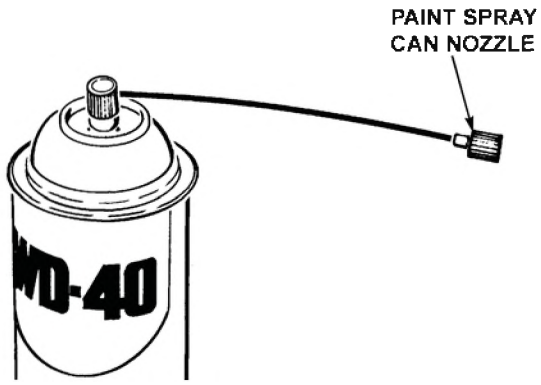


2.

2. Scott Rhoades, of Gaines, MI, is a carpenter by trade and often uses aliphatic resin (aka carpenters glue) in his work. Like many modelers, he also uses it when building airplanes. Scott, however, feels that the glue's containers leave a lot to be desired, so he discovered a better option. Scott now keeps his glue in emptied and cleaned plastic squeeze bottles in which he buys mustard. Most mustard containers (and some others) have a tip that opens and closes with a quarter turn, making it easy to use and easy to remove the dried glue. It also stays virtually clog free. The best part, though, is that it lays a nice, clean, even bead of glue. The only downside, in fact, is if you forget which bottle has the glue and which still has mustard when you make a sandwich. No, he never glued his ham to the cheese, he says, but he once found his missing glue bottle in the refrigerator, apparently visiting its long lost friends, Mr. Ketchup and Ms. Mayonnaise.

3. (No illustration) Walter Becker, of Huntingdon Valley, PA, has been flying R/C for more than 28 years, and has developed a procedure to keep his mufflers from coming loose. The usual reason mufflers come loose is that the gasket between the muffler

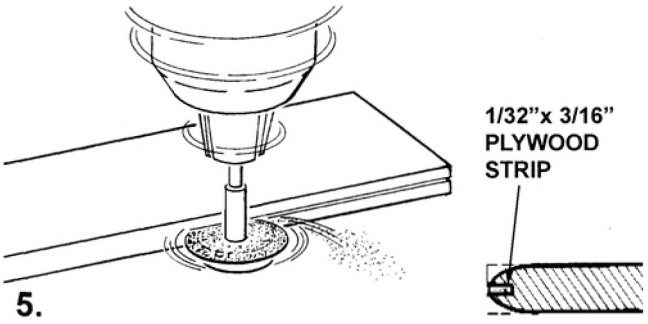
and the engine becomes compressed over time, resulting in loose muffler screws. Once the muffler becomes loose, vibration and exhaust gasses quickly finish off the gasket. Walt's solution is both simple and effective, don't use the gasket! Most modern 2C engines are now manufactured with perfectly flat mating surfaces at the muffler and exhaust port, making the gaskets unnecessary. Simply install the muffler without the gasket, and tighten the screws evenly. If worried about exhaust leakage, use a little high-temp silicone sealant to fill the gaps.



4.

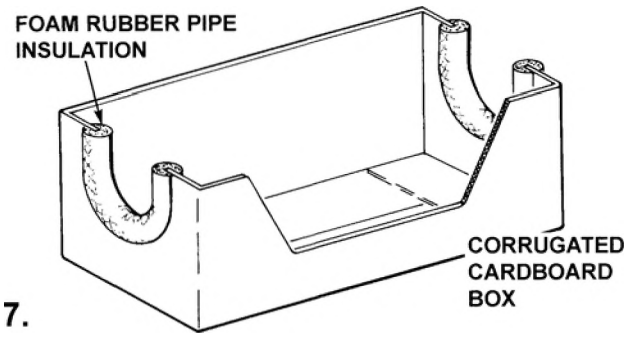
4. Don Madison, of San Diego, CA, has found still another way to keep spray can nozzles unclogged and ready to go the next time they're needed. He lightly sands the end of the red plastic tube that comes with WD-40 cans, until it fits into the bottom of the spray nozzle. When finished spraying paint, a quick squirt of WD-40 will remove any paint residue left in the nozzle. The whole procedure takes only seconds, and

the nozzle is ready for use. The first "trial squirt" of paint will clear away any residual WD-40, too.

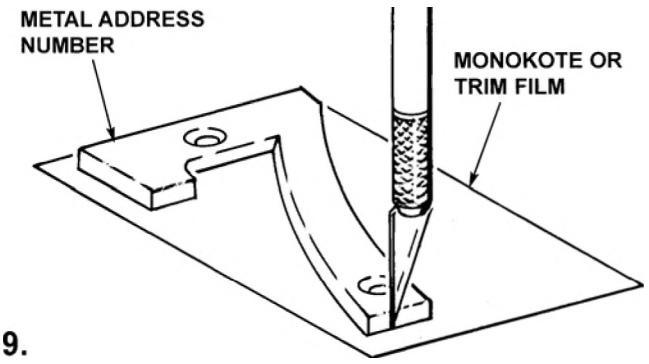


5. Bill Predock, of St. Charles, MO, reinforces the edges of his tail surfaces with thin strips of plywood. He uses a Dremel cutoff wheel in his drill press to accurately cut slots around the outer edges. The chucked cutoff wheel is adjusted to a height equal to half the thickness of the wood, and is locked in place. The wood part is then fed along the spinning wheel, cutting as deeply as desired. The resulting slot is clean and accurate, and different cutoff wheels will cut different size slots. The mating parts are cut with the same side facing down, so even if the tool isn't perfectly centered, the slots still match with no misalignment of the surfaces. Strips of 1/32" plywood are cut into strips approximately 3/16" wide, and glued into the slots. CA works quickly, of course, but white glue doesn't harden the surrounding balsa as much, leaving it easier to sand. The plywood reinforces the edges to help prevent dents and dings, as well as providing a guide for accurately sanding the edge to the desired shape. (Walt's Note: Dremel once sold a saw wheel only 0.025" thick. I still have one and use it this way myself, for lighter 1/64" plywood strips. It's also great for cutting hinge slots for CA hinges. I don't think the saws are currently manufactured, though, but you might find them at a store with some old stock on hand.)

6. (No illustration) From Don Overfelt, of Monrovia, MD. Got an old transmitter lying around, with a long, telescoping antenna? It's no longer trash, it's a tool! Don uses a telescoping antenna to take all those symmetry measurements when installing the horizontal stabilizer on a new model. It extends and collapses easily, but holds its length until you change it. He finds it much easier than using string or a yardstick, since we don't need to know the exact distances, we only need to make them exactly the same. (Walt's Note: Old transmitters, even *without* their antennas, can be used as buddy boxes with an appropriate trainer cord.)



7. From Earl Acker, of Fenton, MO. A number of fuselage cradles are commercially available, but most are nearly the same size. Earl makes inexpensive and custom-size cradles from empty cardboard boxes. Just cut two opposing sides to the desired shape and size, and line the cardboard edges with 1" foam rubber pipe insulating material, which costs about $1.00 per 6' length at your friendly home improvement or hardware store. Part of one or both sides can be cut out to provide access to tools or parts, as long as the 90° corners are retained for strength. If you can find boxes in the sizes you need, you can make one for each of your models.



9. Here's one from me. You know those big metal or plastic house numbers you can buy for the front of your house? I use them as templates for cutting numbers from iron-on coverings. Just tape the number onto the material and carefully cut around it with a sharp hobby knife. If you want an outline on the number, first use MonoKote Trim Solvent (or acetone) to adhere the cutout number to a contrasting color material. Then using scissors, cut the contrasting color approximately 1/8" to 1/4" larger than the number, or leave a wider edge on the bottom and one side to simulate a "drop shadow." Then use the solvent again to adhere the numbers to your model. Heating may distort the numbers, but the Trim Solvent leaves them nice and flat, as long as the surface is basically flat. Such house numbers are available in a variety of sizes and font styles at most home improvement and hardware stores. *-Walt Wilson, St. Charles, MO*
rallyo@charter.net

2009

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- **Wingspan: 69 in (1755 mm)**
- **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)**
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062	1/32 x 3	0.58
063	1/16 x 3	0.58
064	3/32 x 3	0.69
065	1/8 x 3	0.82
066	3/16 x 3	0.99
067	1/4 x 3	1.22
068	3/8 x 3	1.54
069	1/32 x 4	0.87
070	1/16 x 4	0.87
071	3/32 x 4	1.03
072	1/8 x 4	1.22
073	3/16 x 4	1.43
074	1/4 x 4	1.63
075	3/8 x 4	2.56

36" Sheets

001	1/32 x 2	0.59
002	1/16 x 2	0.60
003	3/32 x 2	0.71
004	1/8 x 2	0.79
005	3/16 x 2	0.93
006	1/4 x 2	1.09
007	5/16 x 2	1.12
008	3/8 x 2	1.35
009	1/2 x 2	1.71
012	1/32 x 3	0.70
013	1/16 x 3	0.70
014	3/32 x 3	0.77
015	1/8 x 3	0.99
016	3/16 x 3	1.20
017	1/4 x 3	1.48
018	5/16 x 3	1.73
019	3/8 x 3	1.80
020	1/2 x 3	2.36
021	3/4 x 3	3.49
025	1/32 x 4	1.07
026	1/16 x 4	1.05
027	3/32 x 4	1.29
028	1/8 x 4	1.45
029	3/16 x 4	1.73
030	1/4 x 4	2.41
031	5/16 x 4	2.84
032	3/8 x 4	3.30
033	1/2 x 4	4.46

42" Sheets

080	1/32 x 3	0.78
081	1/16 x 3	0.80
082	3/32 x 3	0.95
083	1/8 x 3	1.14
084	3/16 x 3	1.37
085	1/4 x 3	1.73
086	3/8 x 3	2.14
087	1/32 x 4	1.22
088	1/16 x 4	1.22
089	3/32 x 4	1.63
090	1/8 x 4	1.68
091	3/16 x 4	2.09
092	1/4 x 4	2.54
093	3/8 x 4	3.64

48" Sheets

037	1/32 x 3	0.92
038	1/16 x 3	0.92
039	3/32 x 3	1.10
040	1/8 x 3	1.35
041	3/16 x 3	1.63
042	1/4 x 3	2.03
043	5/16 x 3	2.40
044	3/8 x 3	2.47
045	1/2 x 3	3.21
046	3/4 x 3	4.76
050	1/32 x 4	1.82
051	1/16 x 4	1.44
052	3/32 x 4	1.76
053	1/8 x 4	2.01
054	3/16 x 4	2.41
055	1/4 x 4	2.84
056	5/16 x 4	3.60
057	3/8 x 4	4.48
058	1/2 x 4	5.22

6" Wide Sheets - 36" Length

185	1/16 x 6	1.85
186	3/32 x 6	2.03
187	1/8 x 6	2.24
188	3/16 x 6	2.55
189	1/4 x 6	3.15
190	3/8 x 6	4.26
191	1/2 x 6	5.66

6" Wide Sheets - 48" Length

265	1/16 x 6	2.46
266	3/32 x 6	2.67
267	1/8 x 6	2.97
268	3/16 x 6	3.40
269	1/4 x 6	4.13

36" Matched Sheets

MS027	3/32 x 4	1.56
MS028	1/8 x 4	1.92
MS029	3/16 x 4	2.08
MS030	1/4 x 4	2.42

42" Matched Sheets

MS089	3/32 x 4	1.81
MS090	1/8 x 4	2.19
MS091	3/16 x 4	2.41
MS092	1/4 x 4	2.58

48" Matched Sheets

MS052	3/32 x 4	2.08
MS053	1/8 x 4	2.44
MS054	3/16 x 4	2.78
MS055	1/4 x 4	3.01

30" Balsa Wing Skins

286	1/16 x 10	5.44
287	3/32 x 10	6.58
288	1/8 x 10	7.67

36" Balsa Wing Skins

289	1/16 x 10	6.58
290	3/32 x 10	7.92
291	1/8 x 10	9.27

48" Balsa Wing Skins

292	1/16 x 10	10.67
293	3/32 x 10	12.77
294	1/8 x 10	15.04

36" Sticks

124	1/16 x 1/16	0.15
123	1/16 x 1/8	0.15
831	1/16 x 3/16	0.18
125	1/16 x 1/4	0.19
126	1/16 x 3/8	0.20
832	1/16 x 1/2	0.26
833	1/16 x 3/4	0.35
834	1/16 x 1	0.43
835	3/32 x 3/32	0.18
836	3/32 x 1/8	0.19
837	3/32 x 3/16	0.20
127	3/32 x 1/4	0.23
128	3/32 x 3/8	0.24
838	3/32 x 1/2	0.29
839	3/32 x 3/4	0.40
840	3/32 x 1	0.46
129	1/8 x 1/8	0.16
841	1/8 x 3/16	0.20
130	1/8 x 1/4	0.23
131	1/8 x 3/8	0.24
132	1/8 x 1/2	0.32
842	1/8 x 3/4	0.43
843	1/8 x 1	0.53
133	3/16 x 3/16	0.20
844	3/16 x 1/4	0.27
134	3/16 x 3/8	0.32
135	3/16 x 1/2	0.37
845	3/16 x 3/4	0.45
846	3/16 x 1	0.58
136	1/4 x 1/4	0.33
137	1/4 x 3/8	0.42
138	1/4 x 1/2	0.44
139	1/4 x 3/4	0.63
140	1/4 x 1	0.78
141	5/16 x 5/16	0.42
847	5/16 x 3/8	0.46
848	5/16 x 1/2	0.58
849	5/16 x 3/4	0.69
850	5/16 x 1	0.88
142	3/8 x 3/8	0.54
143	3/8 x 1/2	0.60
144	3/8 x 3/4	0.82
851	3/8 x 1	1.03
145	1/2 x 1/2	0.74
146	1/2 x 3/4	0.91
147	1/2 x 1	1.16
852	5/8 x 5/8	0.85
853	5/8 x 1	1.31
854	3/4 x 3/4	1.13
855	3/4 x 1	1.45

48" Sticks

856	1/8 x 1/8	0.18
160	1/8 x 1/4	0.30
161	1/8 x 3/8	0.33
162	1/8 x 1/2	0.42
163	3/16 x 3/16	0.33
164	3/16 x 3/8	0.43
165	3/16 x 1/2	0.51
857	3/16 x 3/4	0.60
166	1/4 x 1/4	0.45
167	1/4 x 3/8	0.52
168	1/4 x 1/2	0.59
169	1/4 x 3/4	0.88
170	1/4 x 1	1.16
171	5/16 x 5/16	0.53
172	3/8 x 3/8	0.70
173	3/8 x 1/2	0.85
174	3/8 x 3/4	1.04
175	1/2 x 1/2	0.95
176	1/2 x 3/4	1.31
177	1/2 x 1	1.53

36" Triangles

105	1/4 x 1/4	0.46
106	3/8 x 3/8	0.52
107	1/2 x 1/2	0.63
108	3/4 x 3/4	0.87
109	1 x 1	1.10
110	1-1/2 x 1-1/2	2.04
111	2 x 2	3.42

36" Trailing Edges

100	1/16 x 3/4	0.50
099	1/8 x 1/2	0.48
101	3/16 x 1/2	0.45
103	1/4 x 5/8	0.49
118	1/4 x 1	0.59
102	5/16 x 3/4	0.53
119	5/16 x 1-1/4	0.71
120	3/8 x 1-1/2	0.87
121	1/2 x 2	1.36

36" Tapered Aileron & Elevator Stock - 36" Lengths

224	1/4 x 1	0.90
225	1/4 x 1-1/4	1.04
226	1/4 x 1-1/2	1.16
227	1/4 x 2	1.29
211	5/16 x 1-1/4	0.72
228	5/16 x 1-1/2	1.17
229	5/16 x 2	1.34
212	3/8 x 1-1/4	0.88
230	3/8 x 1-1/2	1.31
231	3/8 x 2	1.51
232	3/8 x 2-1/2	1.60
213	1/2 x 1-1/2	0.91
214	1/2 x 2	1.38

48" Lengths

236	1/4 x 1	1.29
237	1/4 x 1-1/4	1.43
238	1/4 x 1-1/2	1.60
239	1/4 x 2	1.77
215	5/16 x 1-1/4	1.62
240	5/16 x 1-1/2	1.63
241	5/16 x 2	1.85
216	3/8 x 1-1/4	1.81
242	3/8 x 1-1/2	1.79
243	3/8 x 2	2.07
244	3/8 x 2-1/2	2.23
217	1/2 x 1-1/2	1.84
218	1/2 x 2	2.30

Miscellaneous Assorted Wood

598	Bag-A-Balsa Sheets & Sticks	5.88
698	Bag-A-Blocks (when available)	6.65

Hand Selection of Balsa is available in "Hard", "Medium", or "Soft" grades. Please specify your selection type and add an additional 25% to the price of the item to be hand selected. This excludes: 1/16 sq. & 3/32 sq. sticks. **NOTE:** All wood is "Hand selected" only - it is not scale weighed.

Blocks

196	2 x 2 x 2 (Three For)	1.34
197	3 x 3 x 3	0.99
245	1 x 2 x 6	0.61
246	2 x 2 x 6	0.94
247	3/4 x 3 x 6	0.71
248	1 x 3 x 6	0.91
249	2 x 3 x 6	1.41
599	3 x 3 x 6	1.70
250	1 x 4 x 6	1.23
251	2 x 4 x 6	1.87
252	3 x 4 x 6	2.82
198	1 x 2 x 12	1.29
253	3/4 x 3 x 12	1.27
199	1 x 3 x 12	1.80
200	1 x 4 x 12	2.38
201	2 x 2 x 12	1.87
202	2 x 3 x 12	2.84
254	2 x 4 x 12	3.48
255	3 x 4 x 12	5.25
112	1 x 2 x 36	3.67
113	1 x 3 x 36	5.33
114	1 x 4 x 36	6.84
115	2 x 2 x 36	5.36
116	2 x 3 x 36	7.96
256	3 x 3 x 36	10.90
257	3 x 4 x 36	18.90

Birch Motor Mount Stock

748	3/8 x 3/4 x 12	0.61
749	1/2 x 3/4 x 12	0.72
750	5/8 x 3/4 x 12	0.75
751	3/4 x 3/4 x 12	0.82

Landing Gear Blocks Grooved Bass - 3/8 x 3/4 x 12

208	1/8"	0.56
209	5/32"	0.56
210	3/16"	0.56

Hardwood Dowels

355	1/8 x 36	0.18
356	3/16 x 36	0.19
357	1/4 x 36	0.22
358	5/16 x 36	0.30
359	3/8 x 36	0.40
360	1/8 x 48	0.25
361	3/16 x 48	0.26
362	1/4 x 48	0.30
363	5/16 x 48	0.39
364	3/8 x 48	0.50

36" Basswood Sticks

680	1/16 x 1/8	0.26
681	1/16 x 3/16	0.26
682	1/16 x 1/4	0.28
683	3/32 x 1/8	0.28
684	3/32 x 3/16	0.28
685	3/32 x 1/4	0.29
278	1/8 x 1/8	0.24
610	1/8 x 3/16	0.29
279	1/8 x 1/4	0.34
280	1/8 x 3/8	0.40
611	1/8 x 1/2	0.47
612	1/8 x 3/4	0.54
281	3/16 x 3/16	0.33
613	3/16 x 1/4	0.37
614	3/16 x 3/8	0.46
615	3/16 x 1/2	0.55
282	1/4 x 1/4	0.52
283	1/4 x 3/8	0.60
284	1/4 x 1/2	0.70
285	3/8 x 3/8	0.72

48" Basswood Sticks

686	3/32 x 1/8	0.35
687	3/32 x 3/16	0.35
688	3/32 x 1/4	0.43
616	1/8 x 1/8	0.33
617	1/8 x 3/16	0.37
300	1/8 x 1/4	0.41
301	1/8 x 3/8	0.53
618	1/8 x 1/2	0.62
619	1/8 x 3/4	0.72
302	3/16 x 3/16	0.42
620	3/16 x 1/4	0.48
621	3/16 x 3/8	0.60
622	3/16 x 1/2	0.72
303	1/4 x 1/4	0.65
304	1/4 x 3/8	0.78
305	1/4 x 1/2	0.92
306	3/8 x 3/8	0.96

42" Basswood Spar Stock

623	1/4 x 5/8	1.03
624	1/4 x 3/4	1.21
625	5/16 x 5/8	1.16
626	5/16 x 3/4	1.39
641	3/8 x 3/4	1.68
642	3/8 x 1	2.27

36" Basswood Triangles

315	3/8 x 3/8	0.62
316	1/2 x 1/2	0.87
317	3/4 x 3/4	1.11

42" Shaped Bass Wing Struts

276	3/8 x 5/8	4.25
277	1/2 x 7/8	6.37

Birch Plywood Wing Skins

352	1/64 x 48 x 48	60.00
A352	TWO FOR	110.00

Premium Model Grade AAA Poplar Light Plywood

A327	1/8 x 6 x 24	1.71
A328	1/4 x 6 x 24	2.42
A330	1/8 x 12 x 24	3.28
A331	1/4 x 12 x 24	4.75
327	1/8 x 6 x 48	3.25
328	1/4 x 6 x 48	4.74
330	1/8 x 12 x 48	6.44
331	1/4 x 12 x 48	9.23

12" Birch Aircraft Plywood

B333	1/64 x 6 - 3 ply	2.55
B334	1/32 x 6 - 3 ply	1.67
B335	1/16 x 6 - 3 ply	1.78
B336	3/32 x 6 - 5 ply	2.74
B337	1/8 x 6 - 5 ply	2.81
B338	3/16 x 6 - 4 ply	1.66
B339	1/4 x 6 - 5 ply	2.01
B340	3/8 x 6 - 7 ply	2.34
B344	1/64 x 12 - 3 ply	4.39
B345	1/32 x 12 - 3 ply	2.79
B346	1/16 x 12 - 3 ply	2.97
B347	3/32 x 12 - 5 ply	4.74
B348	1/8 x 12 - 5 ply	4.85
B349	3/16 x 12 - 4 ply	2.77
B350	1/4 x 12 - 5 ply	3.40
B351	3/8 x 12 - 7 ply	3.98

24" Birch Aircraft Plywood

A333	1/64 x 6 - 3 ply	4.70
A334	1/32 x 6 - 3 ply	2.94
A335	1/16 x 6 - 3 ply	3.15
A336	3/32 x 6 - 5 ply	5.08
A337	1/8 x 6 - 5 ply	5.20
A338	3/16 x 6 - 4 ply	2.92
A339	1/4 x 6 - 5 ply	3.60
A340	3/8 x 6 - 7 ply	4.25
A344	1/64 x 12 - 3 ply	8.37
A345	1/32 x 12 - 3 ply	5.17
A346	1/16 x 12 - 3 ply	5.52
A347	3/32 x 12 - 5 ply	9.06
A348	1/8 x 12 - 5 ply	9.27
A349	3/16 x 12 - 4 ply	5.13
A350	1/4 x 12 - 5 ply	6.39
A351	3/8 x 12 - 7 ply	7.56

48" Birch Aircraft Plywood

333	1/64 x 6 - 3 ply	8.99
334	1/32 x 6 - 3 ply	5.47
335	1/16 x 6 - 3 ply	5.85
336	3/32 x 6 - 5 ply	9.75
337	1/8 x 6 - 5 ply	9.98
338	3/16 x 6 - 4 ply	5.43
339	1/4 x 6 - 5 ply	6.80
340	3/8 x 6 - 7 ply	8.10
344	1/64 x 12 - 3 ply	15.73
345	1/32 x 12 - 3 ply	9.57
346	1/16 x 12 - 3 ply	10.23
347	3/32 x 12 - 5 ply	17.06
348	1/8 x 12 - 5 ply	17.47
349	3/16 x 12 - 4 ply	9.49
350	1/4 x 12 - 5 ply	11.90
351	3/8 x 12 - 7 ply	14.17

Catalogs $3.00

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THE BIG PICTURE

by Dick Pettit

It's already the third month of the year and I can't seem to keep up with all the things in the works so far. I've already made plans to attend the Perry Swap Shop, the 2009 Toledo Expo, and Top Gun 2009, but the list keeps getting longer. I've been working on another new kit project, and by the time you read this it should be in the air if all goes well. This one will feature a fully scale-detailed interior, and a paint finish that I've never used before. Stay tuned for more details as the project progresses.

This month, I'll show you a pair of beautiful biplanes, I'll tell you how to make a specialty tool right in your own work shop, and I'll show you some preliminary photos of my newest project.

NEED A TAP? MAKE IT!

I was working on a project recently that required me to drill and tap two holes in a piece of nylon. That sounds easy enough, doesn't it? Well, not if you have to drill and tap the holes to fit a 5mm bolt. I guess I could run around town trying to find a tap and matching drill bit, or I could get on the phone with some of my modeler friends asking if they had what I needed. But then I remembered another method of tapping holes in moderately soft materials like hardwood, nylon, and plastic. It's fast, easy, and the supplies are already here in the work shop.

First we need a bolt the same size as the threads we want to tap. Since I was tapping a hole for 5mm threads, I used a 5mm bolt. Look at a drill index and find a suitable pilot drill bit that will still provide enough material in which to tap the threads. I suggest practicing on a scrap piece of material before actually drilling and tapping the final hole. Here's how to make your own tap: Put a thin cut-off wheel in your high speed rotary tool, and grind a slot at the end of the bolt that will be threaded into the tapped hole. This slot or groove should be maybe 1/2" long and a bit deeper than the threads. Be careful not to grind a slot in any fingers *holding* the bolt. The results should look like the bolt seen in **Photo 1**.

Now thread the new "tap bolt" into the pilot hole, turning it no more than two turns, and then remove it. Now remove the pieces of material stuck in the slot you just ground. Then insert the bolt again and turn it three or four turns total, and remove it again. More shavings will be seen. Keep turning and removing the bolt in intervals of two additional turns each time, until the hole is threaded to the depth needed.

The new threaded hole will be just as good as one made by an expensive (and sometimes hard to find) commercially available tap. The same bolt can still be used as a bolt, too.

Photo 1: Homemade thread cutting tap made from a common bolt, by cutting the slot at the end, as seen here, with a moto-tool cutting wheel.

CLONES, COPIES, AND CHEAP KNOCK-OFFS

The following is a copy of a note I found on a website belonging to a new, up and coming engine importer and distributor. I've blanked out his name to prevent the appearance of showing partiality. The only reason I'm even telling you about this is to give you a better understanding of how certain foreign manufacturers "reverse engineer" products, and then sell them for at a low price since they didn't have to engineer the product.

"A while back, I received some emails from modelers who had noticed our engines on E-bay, selling for less than the regular selling cost. I answered them all...

"Yes it's interesting and there's a good reason. It looks like a XX engine, but it's not. You'll find me and all the distributors of the XX engines repeating the same story. XX engines are the most copied and cloned engines bought through third party companies and sold as their own by other engine sellers. Notice that I did not say 'manufacturers'.

"That's why XX engines had to actually retool their engine line-up so that these other substandard designs won't be associated with the XX line. This was completed early this year, and these new engines are getting incredible re

-views. As distributors of these engines, we are really hesitant of talking these engines up. But it really is coming to a point that we need to differentiate ourselves from the lower tier (expletive deleted) manufacturers that are giving the quality engine manufacturers like XX, headaches."

"Gas engines that modelers think are manufactured by the company selling them are in for a big surprise. Many of them are not. They are either contracted out, cloned, copied, forged, or whatever you want to say. There was a seller that actually put a picture of the RCGF 150cc engine on their website and starting selling them as their own brand!!!"

"I see posts that have guys raving about the deals they got for an engine that should cost 100's more. To be fair, some of the deals are real and the buyer is the winner. Talking from personal experience, these deals are few and far between. You know why."

"The engines that are bought from unknown sellers are junk, made with substandard materials. They'll run for a couple of hours or maybe even a season, and then die. The seller has dozens of these cloned and copied engines and he is selling them one at a time. The posts on all the popular R/C sites are full of these stories. So now a happy modeler becomes a (expletive deleted)-off consumer, looking for some kind of redress. Good luck... go ahead and get some service for them... go ahead."

"Over the summer I dealt with a number of modelers on these issues. It's frustrating and time consuming, but one service that I'm pleased to do, so that I can educate them."

"Here's the kicker on this. Some of the sellers, who were hawking the pseudo XX engines, actually gave the buyers the name and number of our company, so that if any problems were experienced they could call us for imme-

diate service. What a great scam."

"One fella even sent me his engine. The box was a real XX box (or one heck of a good copy!!), and the instructions were written in Urdu (honestly!). The ignition system was blue colored (unknown to me or anyone else that I talked with). Now, to the engine."

"The engine wasn't even close to the look of our engine. Yes it had a cylinder head and a carburetor, but the spark plug did not fit the engine. The seller even painted the muffler shiny black. It took me hours to convince the buyer he'd been had. Man, was he ever angry. I did feel for this guy. He eventually bought one of our legitimate ones."

"Right now, with all the proactive stuff that we've been doing on stemming the cloners and copiers, it seems that these guys have switched tactics. Now, we're seeing cloned YY engines coming on line. I feel for the guys who think that they will be getting the deal, but instead getting the shaft!"

READER'S FLEET

One of our readers sent me a photo CD and a letter describing

Photo 2: Quarter Scale Fleet Model 2 from Harry Antenucci, of Albuquerque, NM.

his latest project, a 1/4-scale Fleet Model 1 biplane, built from the popular Concept Models kit. And, wouldn't you know, it's been decorated and powered just about the same as the one I just finished. How did he know?

Anyway, here's the plane (see **Photo 2**) and its owner, Harry Antenucci, from Albuquerque, NM. Harry writes:

"I guess (in my mind) a Fleet had a square tail. But when I got to the Tucson Scale Classic, I like to go to the Pima Air Museum and lo and behold they have a round tail version there. I prefer it to tell you the truth."

Photo 3: All the wooden parts for my latest kit project

"All five servos are Futaba, and the rudder and elevator servos are in the tail section. The (Zenoah) G-38 is swinging a 18x10 Xoar prop. The covering is similar to Koverall (it was given to me years ago). Some knowledgeable people tell me it's 'Ceconite', but I can't swear to that. The covering is painted with Minwax polycrylic first (two coats) before the paint. I like the polycrylic because it has no odor (like dope), it cleans up with water, and does the same job. I've been converted! The actual paint is Lowes outdoor water-base paint, and the decals are by Callie Graphics."

"I'm working on the cylinders now. I've just added the fuel gauge and fuel line on the top center of

Photo 4: Complete scale interior for the project

the wing. I've had a few flights on it, but I was having so much fun watching it that, although, I had my camera I neglected to ask anyone to take in-flight photos. If weather permits I'll take some photos this weekend. There's only two weeks until the Tucson Scale Classic and I need more stick time with it."

Great job, Harry!

SNEAK PEEK

I thought I'd tease you with a few photos of my newest project. Since it won't be complete for a while yet, my "kit count" for 2008 will remain at two. But that's still more kits than I've built per year in a long time.

Photo 3 shows what the kit contents look like, right from the box. As you can see, there are many individual wood parts to be glued together, and many that have to be cut to size before gluing. Man I love the smell of balsa dust in the morning!

Once a number of these parts have been glued together, the individual structures are sheeted with balsa and then covered with thin fiberglass cloth applied using clear, water base polyurethane to fill the weave. Once the glass and polyurethane have cured, it's then primed, sanded, primed again, and made

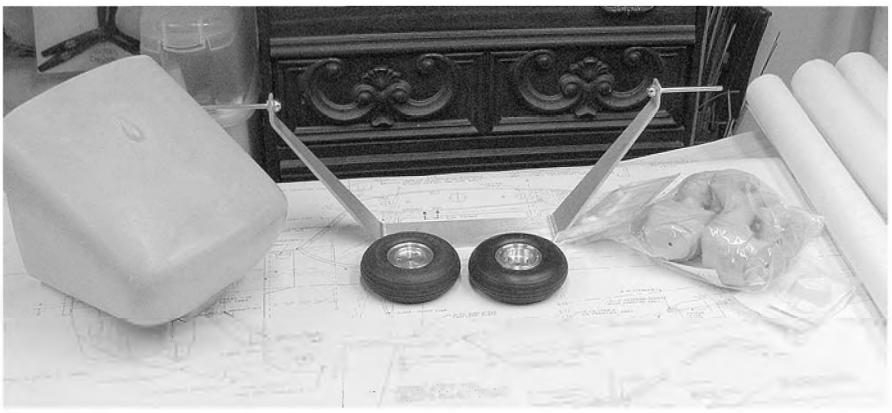

Photo 5: Plans and accessories for my latest project

ready for paint. I'll be using some really high tech paint on this model, house paint applied with a spray gun!

After the plane is framed up, there's a complete scale interior that has to be cut from vacuum formed plastic parts, along with other details that come in the kit. The interior kit comes from Dynamic Balsa. **Photo 4** shows these parts prior to cutting, fitting, and installation. They'll be painted a flat military green before installation, and I have a scale pilot figure to go in the driver's seat.

I don't want to reveal any more details about this project just yet, but it's progressing nicely. I work on it about two to three hours each evening, and maybe eight hours on the weekends. I can get a lot done even during the short building sessions. Much of the construction will be done with yellow carpenters glue, but I'll use Zap and Z-Poxy where necessary.

Finally, these are the plans and accessories that will be used to build the new project (see **Photo 5**). If you look really close, you may be able to see what the model is supposed to look like.

ALABAMA BOUND PT-17

Stan Grett, from Enterprise, AL, sent me a hard copy photo of his Ziroli PT-17 Stearman, seen in **Photo 6**. Stan modeled the Stearman after a full-scale plane stationed at the Tuskegee Airport. The kit was cut by All American Kit Cutters, and it features Robart Robo-Struts. Stan adds... *"I'll probably take some flak by not having a radial engine, but this was the "G Model" (the Grett version) and was the test bed for the Super Stearman."*

Photo 6: Stearman PT-17 from Stan Grett, of Enterprise, AL.

Power comes from a Zenoah G-45 with a B&B spring starter and muffler, turning a Top Flite 20x10 prop. Radio equipment is a JR PCM system with dual batteries and switches, and Airtronics servos. The cowl is from Fiberglass Specialties, and the graphics come from Custom Cut. The plane is painted with Krylon spray paint.

Stan closes with, *"She flew great on her maiden flight, with no bad tendencies."* If it flew as good as it looks, Stan, it'll continue to fly just great.

That's all I have from here right now. It looks like the entire R/C hobby industry is slowing down in the sour economy, much like just about everything else in the world. I've not seen many new kits, ARF's, or even new engines being introduced in the giant sizes. It seems like our industry is heading whole-hog toward smaller, electric models. This may or may not be a good thing, but we'll all have to deal with it as time goes by. Somehow, I'll always be flying at least one giant, and I hope you will too.

LATE ADDITION

Friends, it has come to pass that one of the finest R/C magazines this industry has ever known will be closing once this issue has been distributed. Even if I wasn't a member of this magazine's staff, I would still be a devout fan and reader.

Over 19 years ago, Gordon apparently liked the way I wrote product reviews, s☺ he invited me to join the magazine and write about almost anything I desired, to include many product test reports.

Through *"R/C REPORT"* I have made many friends in the industry, to include major and minor manufacturers and distributors. In most cases, whatever support or parts I needed, I got, with no strings attached.

I have enjoyed the opportunity to see and handle many new and exciting products that would not have been afforded me as just an average modeler. Almost 175 R/C models have been processed through my workshop, with each and every one presenting its own unique challenges and rewards. I have particularly enjoyed answering the question, "How do you build so fast?"

Later I took over the "The BIG Picture" column. Gordon asked me to write something every month about giant models, and like all of our columnists, I was given total freedom in choosing my subjects, and the obligation to be candid and honest at all times. Soon after assuming the reigns of this already-established column, I decided that there was too little information being published for modelers wanting to 'move up' from the .40 and .60 size models to those commonly described as "giants". So that's what I set out to do, and with the help of many readers and friends who provided me with photographs and ideas, I..., no, 'we' became a regular fixture in every issue.

Then there are the trips I've made to some of the nation's finest flying fields, trade shows, and competition events. I had the chance to participate in both Top Gun and the AMA Nationals, and did pretty well at both. The Toledo Expo, the WRAM Show, and the AMA Convention have also been highlights of my writing career.

While the curtain is coming down on one aspect of my life, another may be just beginning. I've been contacted by several other R/C media outlets asking me to write for them. To some I sent a cordial, "Thanks, but no thanks", since I have no intentions of abandoning the goals and ideals established by this magazine. I am currently negotiating with others, so you may find my contributions elsewhere in the near future.

I'll really miss people coming up to me at flying events, trade shows and sometimes just out on the street, telling me that they read and enjoy this magazine and my articles. I usually reply with my standard answer, "Oh, you're the one?" But it's truly an honor and a privilege to be read by so many modelers.

Finally, I want to thank Gordon and Mina for the opportunities they've given me, and for putting up with some of my weird habits. Working with Gordon has been educational, enlightening, and more than a little fattening. I've spoken with numerous modelers who write for other magazines, and some are amazed at the freedoms we have enjoyed at *"R/C REPORT"*. It's been great!

My thanks to all the readers who have communicated their requests and suggestions, and to those who reward us with one of the nicest things any modeler could say, *"I only bought that model because you said it was good."*

So now I guess I'll fly off into the sunset, at least temporarily, taking with me nearly 20 years of fond memories. But just remember, if you see me at the flying field, I'll be the one in the ugly shirt.

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

R/C REPORT'S PRODUCT TEST REPORTS INDEX

The following listings, in alphabetical order, use the format of: ITEM TESTED, X, (xx), where X, if necessary, stands for what kind of product (E-engine, K-model kit, R-radio, T-Tool, O-other), and (xx) represents the Issue Number of the latest test of that item, *except* that (B1) stands for "Engines Book #1"(no longer available). Issue #1 was dated August 1986. Products tested more than once are usually listed only under the issue with the latest test. All article photocopies are $3.00 each, postpaid in the USA. See end of listing for more information on ordering back issues and/or photocopies of articles.

(Note: Many reviews having had no reprint orders in over two years have been omitted.)

SPECIAL ARTICLES

COPIES OF ARTICLES

Photocopies of past articles are $3.00 each, post-paid in the USA. Make sure you're not ordering two or more articles ($6.00+) from an available back issue ($5.00). Please specify the name of the article and the issue number when ordering.

BACK ISSUES (List updated on March 18, 2009)

The following back issues are available for immediate shipping, but those accompanied by an asterisk (*) are in *very* short supply. Please order by issue number, and include $3.00 each, plus $2.00 postage for the first copy, and 75¢ postage for each additional copy, USA and Canada only. Foreign orders other than Canada please include U.S. $12.00 postage for 1-4 copies.

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If you need earlier copies, please send (mail or email) a list of your needs before placing your order. What was once a plentiful supply is now a pitiful supply! (Thanks for your orders, guys.)

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PRODUCT TEST REPORT

Great Planes ARF Piper Cherokee

Model Reviewed..... ARF Piper Cherokee
Model Type..... Fun Scale Sport and Aerobatic
Manufacturer..... Great Planes Model Mfg.
(Made in China)
Distributor..... Great Planes Model Distr. Co.
P.O. Box 9021
Champaign, IL 61826-9021
(217)398-3630
www.greatplanes.com
Typical Street Price..... $159.99
Wing Span..... Advertised: 60"
Measured: 60"
Wing Area..... Advertised: 606 sq.in.
Measured: 609 sq.in.
Advertised Weight..... 6.75 - 7.25 lbs.
Airfoil..... Semi-symmetrical
Wing Structure..... Built-up balsa and plywood
Wing Joiner Method..... Single aluminum tube
(13x0.71", or 330x18mm)
Fuselage Structure.... Built-up balsa and plywood
Fuselage Length..... Advertised - 46"
Measured - 46.2"
Pushrod Type..... Steel wires (0.075")
Pushrods Installed..... Guide tubes only
Hinges Installed..... Yes, on all surfaces
Recommended Controls. . 4-5 (Ail, El, Rud, Throt, plus optional Flaps)
Recommended Power..... .40-46 2C, .52-56 4C, or electric equivalent
Engine Mount Installed..... No
Engine Mount Type..... Two-piece composite
Fuel Tank Included..... 14.2 oz. (420cc)
Landing Gear Installed..... No
Wheels Included..... Three 2.5"
Assembly Instructions..... 25 pages (8.5x11") with many illustrations
Hardware: Metric or SAE..... Mixed
Included in Kit..... Red plastic 2" spinner, two-piece composite engine mount, fiberglass cowl and wheel pants, unassembled 14.2 oz. fuel tank kit, one knurled aluminum fuel line stopper, built-in fuselage servo tray, all necessary pushrod materials and connectors, nylon control horns, pre-installed hinges, pre-assembled cockpit assembly with painted interior and pre-installed pre-painted pilot bust, pre-formed 5/32" music wire landing gear wires with mounting hardware, nylon nose gear bearings and steering arm, three 2.5" firm foam wheels with white plastic rims, wheel collars, two 1/4" nylon wing bolts, two 12" lengths of 3/4" wide Velcro, two ABS plastic "flap locks" for those not using working flaps, lots of nuts and bolts and washers, decal sheet with N-numbers, and two small patches of red & white MonoKote.

Items Needed To Complete for Glow Power
Propeller, engine, Pitts-style muffler (see text), glow fuel line, a 2x5" sheet of firm 1/4" foam rubber for the fuel tank tray, a 4-ch radio system (5-ch if using flaps) with five standard servos (seven if using flaps), one 6" Y-harness (two if using flaps), and two 7" aileron servo extensions.

Items Needed To Complete for Electric Power
Propeller, motor, motor mount, speed controller, motor battery, 4-ch radio system with four standard servos (5-ch radio and six servos if using flaps), one 6" Y-harness (two if using flaps), and two 7" aileron servo extensions, (Recommended power system using Great Planes components: Rimfire 42-50-800 brushless outrunner motor (GPMG4700), Great Planes medium brushless motor mount (GPMG1255), Great Planes Silver Series 60 Amp brushless speed controller (GPMM1850), and a 3200 mah 20C 3-cell LiPo battery connected *in series* with a 3200 mah 20C 2-cell LiPo battery (GPMP0623 and GPMP0622), using a 10x5 to 11x5.5 prop.

Covering Material. . . . . Top Flite MonoKote (red, white, and black)
Drilling Required. . . . . Yes
Fuel Proofing Required. . . . . Yes
Estimated Assembly Time. . . . . 16 hours
Estimated Skills Required. . . . . Experienced
Assembly Tools Required. Typical modeling tools to include a drill motor and Dremel-type tool with assorted bits, a 6-32 tap and drill set for the motor mounts, and an assortment of SAE and metric ball drivers or Allen wrenches.
Adhesives Required. . . . . Thin CA only

COMPLETED MODEL
Finished Weight (RTF, dry). . . 6 lbs. 1 oz. (97 oz.)
Wing Loading. . . . . 22.94 oz./sq.ft.
Engine Used. . O.S. .46AX (13.26 oz. engine only) with a Bisson Pitts-style muffler (2.9 oz.)
Propeller Used. 11x6
Propshaft to Ground. . . . . 7.6"
Fuel Tank Used. . . . . As supplied (14.2 oz.)
Radio Used. . . . . Futaba 10C transmitter with an R617FS receiver (0.3 oz.), seven S3003 servos (1.3 oz. ea.), a 1000 mah 4-cell NiCd receiver battery (4.2 oz.), two 6" Y-harnesses, and two 7" aileron servo extensions.
Covering/Finishing Used. . . . . Comes pre-covered
Special Items. . . . . Bisson Pitts style muffler from Tower Hobbies (BISG4046, $36)

CHEERS - Excellent packaging to prevent shipping damage; beautifully done fiberglass cowl and wheel pants; excellent workmanship on pre-built assemblies; bolt-on tail design; two-piece wing; pre-assembled cockpit is already painted inside, and is complete with a pre-painted pilot bust; double-bagged nuts and bolts package; pre-hinged control surfaces; kit includes numerous special parts for an electric power system, and the instructions specify the exact electric power system requirements; landing gear wires have pre-tapered ends (i.e., no rough edges); very good instructions include an accurate paper ruler with an inches and millimeters side, plus a metric conversion chart; and much more (see text); super good looks on runway and in-flight; completed model is *much* lighter than advertised; superb flight characteristics in a very wide speed envelope.

Although not at all necessary, the flaps are nicely effective for take-offs and landings.

JEERS- Requires a Pitts-style muffler (or a stock muffler extension plus modifications to the fuselage); the recommended low-rate control surface throws are rather aggressive for the average flyer.

My Cherokee kit arrived in perfect health due to excellent packaging. Although not rare now, the beautifully pre-assembled fuselage, with its many laser-cut lightening holes, is still impressive, as are the beautifully finished fiberglass cowl and wheel pants. The pants have pre-formed, self-aligning, attachment pockets for the landing gear wires. The bolt-on tail and two-piece wing with an aluminum tube joiner are pure ARF, of course, but will ease transportation and repairs. The pre-assembled cockpit already has a nicely painted interior and pre-painted sport pilot figure.

Oh, here's a relatively minor but much appreciated little detail. The bag of metal nuts and bolts was double-bagged in very thick plastic to prevent ruptures leading to hardware floating throughout the kit box, sometimes marring other parts, and often finding their way into a parallel universe, never to be seen again. With this kit, you can rest assured that the above problems will not occur.

Modelers don't buy ARF's and RTF's for the joy of installing hinges, and here they won't have to. All of the control surfaces are pre-hinged. We do have to install the control horns, but even that chore has been abbreviated on the ailerons by using self-tapping screws threaded into CA-strengthened wood instead of machine screws threaded into those pesky control horn nut-plates.

I'm assembling my Cherokee with an O.S. .46AX glow engine, but the kit includes numerous specialized parts for an electric power system, and the instructions specify the exact electric power system recommended.

I've seen two or three examples of the same Great Planes ARF come with fair to excellent covering work, so your kit may differ. This one was average at best, with quite a few wrinkles, but none that were impossible to remove.

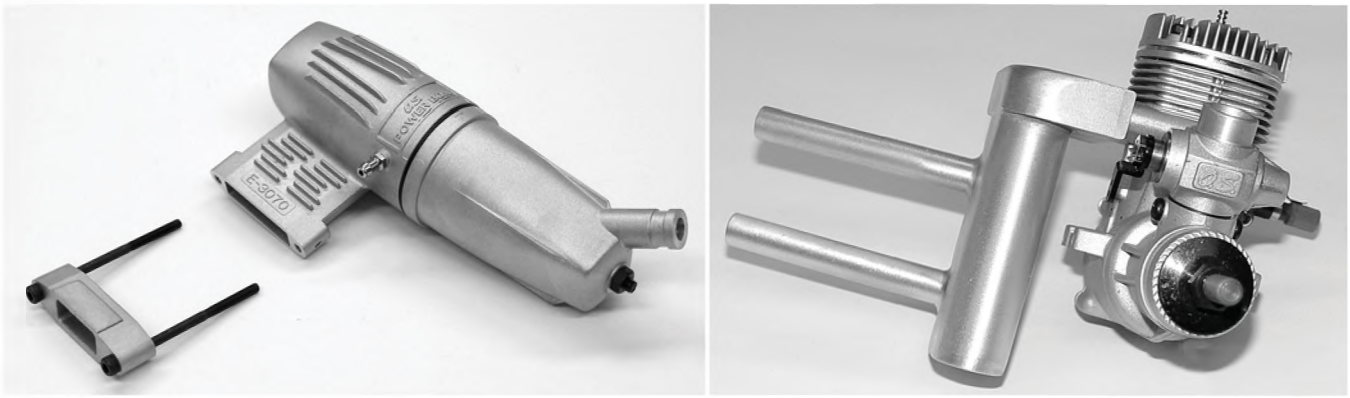
You know why this kit has no wing-bolt crush plate to be added to the wing bolt holes? Because Great Planes had 1.5" circles of plywood installed at each hole, flush with the wing surface, and under the covering. I smiled again at the three, preformed landing gear wires. The cut ends have already been de-burred and ground to a slight taper, leaving them smooth and free of burrs and/-or cutting flash. Minor, yes, but another nice touch. This kit bristles with minor but much admired details, like the metric conversion ruler and chart printed on page 6 (the 7" side has 1/16" increments, while the 180mm side is in 1mm increments). Good job, Great Planes!

There were still more things noted during the kit inventory that impressed me, but let's get on with the assembly, and see how well all those beautiful parts come together. I'll be using Zap CA's and Pacer epoxies to bring all the pieces together, simply because I've always had great results from both adhesives. When using any modeling chemicals, and when sanding and carving parts, be sure to provide adequate ventilation to help prevent respiratory problems. I like to work with a small electric fan blowing gently across my face to keep fumes and particles away.

Assembly Notes

The two-piece wing, joined with an aluminum tube, has ailerons and optional flap, and the four servos are installed on the servo compartment hatch covers. The instructions are very good here, and no servo reversing is needed for the flaps. The book calls for 9" aileron servo extensions, but 7" will do.

When it comes time to fasten the stabs to the fuselage, it's done with screws, not glue. I jumped



Left: With one extension, the O.S. .46AX muffler will work, but the cowl will require more cutting, and the firewall will have to be modified. At right is the $36 Bison Pitts-style muffler. It makes assembly easier, and makes the completed model look nicer. I later shortened the tubes by about half. The noise level is higher than the O.S. muffler, but is still acceptable.

ahead to install the radio gear, engine, and fuel tank first, however, to help prevent hangar rash to the tail feathers while turning the fuselage this way and that so many times while installing all that stuff.

Note that the fuselage servos are installed in the bottom through the wing opening, not in the top through the cockpit hatch.

After separating the taped bundle of pushrod wires, be sure to clean off the sticky tape residue.

The pushrod tube for the rudder provides a smooth and friction-free guide for its pushrod, but its exit hole is so much closer to the fin than the length of the control horn, the outward pressure on the pushrod causes a bind. I had to form a 3/8" dog-leg bend just outside the exit.

The pushrod guide tube for the elevator, however, makes an internal bend just before the exit hole, causing some binding and dragging. I found some burrs right at the exit of the pushrod tube, and trimming those away helped, but I ultimately had to clean and spray the elevator pushrod with a dry lubricant (I've used and like LPS Heavy Duty Silicone Lubricant and Dupont Teflon Multi-Use Dry Wax Lubricant).

When assembling the fuel tank, I had a *great* deal of difficulty getting the stopper into the tank's opening. It's a *tight fit!* Also, before installing the hook and loop straps into the slots in the fuel tank tray, note that the tray has a long and short side to fit the angled firewall. Be sure you have the long side on the left side of the fuselage, and be sure to lay some firm foam rubber under the tank to keep pressure on the tank so it won't slide backwards under the hook and loop straps. Cut off the excess lengths of the hook and loop material to use later for the receiver and battery.

The instructions don't mention this, nor is the wood provided, but I added a 3/8" sq. balsa stick across the fuselage right behind the tank, to make *sure* the tank stays put.

I shouldn't have to mention this, but it might help someone. Each motor mount half has a molding bar across the beams that needs to be removed before using the mounts.

Nice touch alert! The four screws that fasten the motor mounts to the firewall are the proper length! They do *not* protrude into the fuel tank compartment, so they will *not* endanger the fuel tank. These four screws are too long in so many kits, it's a real treat seeing a kit with the proper length screws here.

Installing the engine is pretty normal fare, but the motor mount in my kit was just barely long enough for the O.S. .46AX engine. Had it been even 1/16" shorter I'd have replaced it with a longer mount, or added spacers between the mounts and the firewall.

Now we come to the muffler. I tried an O.S. muffler extension, but that requires a lot more cowl cutting, and some trimming of the firewall. There's already a built-in balsa block in the corner of the fuselage for this very reason, and a piece of white MonoKote in the kit to cover the area after cutting. I opted for the Bison muffler (BISG4046) shown in the instructions. This not only saves a lot of work, it also leaves a neater, nicer looking cowl. Either way, you'll definitely want your muffler on hand before you drill the throttle pushrod hole in the firewall.

The Bison muffler works beautifully, but with one little glitch. Its threaded holes for the muffler screws are not as deep as they should be, or maybe the screws are too long, but the screws bottom out before the muffler is drawn tightly to the engine. I added 4-40 lock washers under the heads of the screws to take up the slack and allow proper tightening.

When setting up the throttle pushrod, a simple dog-leg bend to clear the muffler made for a smooth, almost friction-free installation. (Okay, so I got lucky.) Be sure to use the little black setscrew in the throttle servo EZ-connector. If you try using a socket head cap screw, it will interfere with the wing later on. Use the setscrew.

The landing gear assemblies are simple and easy to do, plus they look really nice. We have to drill four mounting holes for the nose wheel bearing though, which surprised me. This alignment is critical for appear-

ance, ground handling, and for the steering pushrod, so I think those holes should have been drilled at the factory.

As I came to the end of the instructions, I still had four plywood washers large enough for a 6-32 screw. Three of them are used for the electric version, but some of you might need them as spacers behind the short motor mounts if your engine comes up too short.

This may not be a problem for *sure*, but I *sure* didn't like it! The wing servos' connectors exit the wing through a pre-cut round hole exactly 4-3/4" behind the wing's leading edge. So what? Well, the rudder, elevator, and throttle servo arms are 4-3/4" behind the second bulkhead. When the wing is installed on the fuselage, they all come together, and I see a potential for disaster. You might fly like that for years and never have a servo wire jam the elevator servo, or you might fly just once. But even if it's not a major problem, the fix is so easy, I think it would be silly to overlook it. I simply cut new exit holes for the wing servo connectors, right behind the wing's spar, 3/4" ahead of the existing holes.

With everything in place but the 4.2 oz. receiver battery, my Cherokee was tail heavy. I placed the battery right about where the instructions recommend, and it was still tail heavy. But after moving it just *ahead* of the wing's leading edge, it balanced perfectly. So I wrapped the battery in foam rubber, loosened the fuel tank straps, and stuffed that container of angry electrons right down beside the tank on the left side. I also checked the lateral balance and it was almost perfect, so putting the battery on the side opposite the engine's cylinder head is a good idea.

With the completed model on the bench, I slid my scales under it and measured... No, that can't be right. Wait, I'll check it again. Hmmm. Same thing. This kit is advertised as weighing 6.75 to 7.25 lbs., figures I'm guessing to differ due to the optional flaps. But my model's weight doesn't fall into that range by a *long* shot. My model, complete with seven servos, a .46 size engine, and a 1000 mah 4-cell NiCd battery, weighs only 6 lbs. and 1 oz. Now wait just a cotton-pickin' minute here! I'm missing almost a pound! What a rip-off! They advertise seven pounds of airplane but give me only six? (See, you can too complain about goodness if you're crazy enough!)

Oh wait... I haven't put the stickers on yet!

FLYING THE CHEROKEE

First I heard a lot of comments on how nice the model looks, and I certainly agree. Its clean lines and included pilot figure really give it a nice, realistic look, so we have this really pretty sport scale model that flies like a light, high performance pure sport model.

Secondly, the Great Planes ARF Piper Cherokee 6 needs a hot .46 size engine about as much as I need a 460 HP car! I'm not saying it isn't fun, mind you, I'm just saying that any decent .40 would give this Cherokee a level of performance well beyond scale. The hot O.S. .46AX, in fact, *is* fun in this airplane, as Tony made abundantly clear during much of his *"Look Ma, I'm a pylon racer!"* first flight. With a hot .46 in the nose, and a wide-open carburetor, the Cherokee is fast in level flight, and it climbs like a stolen F-15. (If Tony ever gets a pilot's license and invites you along for a ride... good luck with that.)

It sometimes seems that Tony has only two flight modes, pattern and 3D, and since the Cherokee leans a lot more toward the former than the latter, he was soon flying basic pattern maneuvers, and pretty darn well, I'll admit. Loops large and small, rolls fast and slow, inverted passes, rolling circles, and other indications of having way too much fun during a work session. Complain at your own risk, however, because Tony will (and did) set it down well off the end of the runway, and guess who has to go get it?

My only complaint stems from something Tony said *without* complaint. He found the suggested high and low control surface throws very much to his liking. So just trust me here, because the majority of casual sport flyers will find that level of sensitivity excessive! I often use Tony's low rates as my high rates!

The condensed version of all this is that the Great Planes ARF Piper Cherokee is light and aerobatic, so it flies slow or fast. Its performance envelope extends from trainer-like to racer-like, and it looks good in either role. The flaps work nicely just for the fun of it, but the model lands easily and slowly without them. In fact, if I were assembling this kit again, I'd go without flaps, use a lighter receiver battery, and enjoy the maybe 4 oz. weight savings (two servos with arms, linkages, control horns, Y-harness, and the lighter battery).

What's left to say? Frankly, I'm amazed that a kit this good, which results in a model that flies this well, is selling for only $160!

You know that old saying, *"If it sounds too good to be true, then it probably is."*? The word "probably" is in there because every now and then we just might stumble across something that sounds too good to be true but isn't. Take the Great Planes ARF Piper Cherokee kit, for example. *-Gordon Banks*

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PRODUCT TEST REPORT
PARK ZONE "RADIAN"

Model..... The "Radian"
Model Type..... RTF Two-meter electric sailplane
Manufacturer..... Park Zone (Made in China)
Distributor..... Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price..... RTF $329.99
Typical Street Price..... RTF $249.99
(PNP version $199.99/$159.99)
Wing Span..... Advertised: 78.74"
Measured: 78.5" tip-to-tip, 81" across the surface
Wing Area..... Advertised: Not given
Measured: 567.6 sq. in.
Advertised Flying Weight..... 30 oz.
Airfoil..... Under-cambered
Wing Structure..... Two-piece foam with a carbon fiber joiner tube
Fuselage Structure..... Molded foam with plastic cowl, canopy, and some internal structure
Fuselage Length..... Advertised: 44.7"
Measured: 45"
Pushrod Type..... Steel wires in plastic tubes
Pushrods Installed..... Yes
Hinges Installed..... Yes
Radio Included..... Spectrum DX5e (see text)
Recommended Controls..... 3 (El, Rud, Throt)
Motor Included..... Park Zone 480 (960 KV) Brushless Outrunner
Motor Mount Installed.. Yes (integral w/fuselage)
Motor Mount Type..... Plastic
Speed Controller Included.... E-flite 30 Amp BL
Motor Battery Included..... 3S 1300 mah LiPo (3.57 oz.)
Instructions.... A 20 page (8.25x11") booklet with many photos covers assembly, sailplane flying tips, radio setup and use, replacement parts, and more, plus a 4-page Quick Start Guide. An additional 24 page booklet covers the DX5e radio system in mode detail, and yet another sheet covers the E-flite 30 Amp BL ESC.
Hardware: Metric or SAE..... Metric
Hardware Included..... Everything required, to include four dry-cell batteries for the transmitter, LiPo motor battery, and a 2-3S cell-balancing charger
Items Needed To Complete..... Nothing
Covering Material..... None required
Estimated Assembly Time... Less than 10 minutes
Estimated Skills Required..... Beginner
Drilling Required..... None
Adhesives Required..... None
Assembly Tools Required..... None

COMPLETED MODEL

Finished Weight w/3.57 oz. btry)..... 26 oz.
Wing Loading..... 6.6 oz./sq.ft.
Prop/Motor/ESC/Btry/Radio Used.. As supplied
Covering/Finishing Used..... Stick-on trim only

CHEERS - Excellent packaging using a custom-made foam carrier to prevent shipping damage (plus the model *can* be quickly and easily disassembled and put back in the box for transportation and/or storage (but see text); a totally complete kit that includes even the four dry cell transmitter batteries for the Spektrum DX5e 2.4 GHz radio, and a 2-3S cell-balancing 12 VDC charger; assembles in 15 minutes or less (which is less time than it takes to charge the battery!); easy-off magnetic canopy for ready access to the radio and battery; more than adequate power (to say the least!); large enough to be easy to see (but see Jeers); a good powered sailplane for beginners, and a good fun, relaxing airplane for all fliers.

JEERS - Lower surfaces need more color to improve high-altitude visibility; non-linear throttle curve (see text); no suggested control surface throws in the instructions; stick-on trim keeps coming loose from the slick foam finish.

The Pre-Installed
Spektrum DX5e Radio System

Transmitter..... Full range 5-ch 2.4 GHz with pre-set dual rates (see text), four servo reversing switches, one Delta-wing mixing switch, digital trims, audible low voltage warning set at 4.7 volts, LED voltage display, comes with four dry cells but has a charge jack for rechargeable batteries, trainer compatible, trainer/binding switch, and a two-position toggle switch for channel 5.

Receiver..... AR500, full range, dual antenna, with dual aileron connections

Servos..... Two Park Zone micros

Instructions..... 7x10" Booklet with 24 pages

Park Zone is known for their totally complete kits offering "instant airplanes" for beginners and old masters alike. Most take less than 30 minutes to assemble, and some, like the Radian here, take less than 10 minutes. But to the best of my knowledge (work with me, work with me!), this is their first full-size (i.e., two-meter span or greater) sailplane.

Assembly requires installing the wing joiner tube into one wing panel, then sliding the two wing panels together while capturing the fuselage in between, and then taping the horizontal stab in place and connecting the elevator pushrod. That's it, folks, that's all there is to it. Then sit back and wait for the battery to charge.

Park Zone probably didn't intend it this way, but if we use new tape on the horizontal stab each time we assemble the Radian for flying, there's nothing stopping us from putting the model (and everything else) back into the shipping carton for transportation and/or storage. It won't fit back in the box with the horizontal stab in place, but that's the only thing stopping it. Just pull off the tape, put it back in the box, and use new tape every time you assemble it

again for flying. To keep everything in place in the box, I used some hook and loop straps where Park Zone had plastic zip-ties. Simple, no? Assembly and disassembly, by the way, require no tools.

You know what? It just dawned on me that the Radian, like all Park Zone models, would make a good winter building project for someone living real close to the equator.

FLYING THE RADIAN

I'd agreed to meet Tony at the RCRC flying site for what was to be our last big flight test session for the magazine. I had the Radian and four other model reviews to complete, so I arrived early to get the planes assembled, photographed, and ready to fly. Once that was done, I sat and waited. And waited. And waited. Not being a particularly patient man, I kept looking at my watch every few minutes, wondering what was keeping Tony. Finally, I could stand it no more. I'd waited nearly seven minutes by then so I was getting bored. So, for no particular reason I can recall other than it being the closest model to me at the moment, I picked up the Radian and tossed it into the wind with the throttle at mid-range. It wasn't a pretty launch. Immediately after release it descended more than I'd anticipated, so I pulled back on the elevator stick and pushed forward on the throttle stick. It wasn't a pretty launch. Now it was climbing almost straight up, so I pushed forward on the elevator stick and reduced throttle. It wasn't a pretty launch.

Once about 100' high I got the Radian settled in at roughly half-throttle. I soon learned that when the transmitter throttle stick is at the 3/4 position, that's about half power. At that power setting, from level flight, the Radian will loop several times. Why I'd want to loop a sailplane I don't know, but I did, and it does. I also learned that when you nail the throttle suddenly from low to high power, it first dives a few feet, and then climbs strongly. I also had trouble trimming the rudder at first, as if the servo wasn't coming back to center after making a turn. Strangely, that problem later disappeared.

I tried several times to force the Radian into a stall, but it wouldn't have any of that. The elevator seems to lose effectiveness early but gradually, so the Radian just keeps on going. The rudder remains effective at any speed.

Before long I was leaning back against a fence post, bumping the rudder every so often just to keep the Radian in sight. This is neat.

I might as well tell you now, I brought five models to the field that day, but took home only four, and the Radian was not among them. But wait until you hear why.

I'll say that I'd been flying the Radian for 10-12 minutes by the time Tony arrived. Since the battery was probably getting low by then, I asked him to come steer the thing while I took pictures. He came right over and took the transmitter, so I hurried (foolish me) back to the pit table, grabbed my camera, and quickly recorded maybe a dozen in-flight shots. We had five models to fly, so I was anxious to get the flying shots before the battery died. With more than enough photos taken, I put the camera away and told Tony I was done, so go ahead and have fun with the Radian (foolish me). I'd already done a few loops earlier under power, but now Tony was doing them with the power off, simply by diving first to gain enough airspeed. Inverted flight? No, not really. Rolls? Let's go with "no" on that one, too.

About 15 minutes later, people began to notice and talk about the Radian having been in the air at least 30 minutes. Wayne went over to talk to Tony about it, and the next thing I knew Tony left the flight line, leaving Wayne holding the transmitter. Thermals were few and short-lived, due to the dark, overcast sky, but Wayne managed to find a few anyway. He also asked what size battery was in the Radian. I didn't recall, but I guessed it was the common size 2100 mah. He said he doubted that, since the model had been flying at least 45 minutes by then. He continued flying for a while until Tony took over again. Tony seemed to enjoy hovering it in the wind about 50-75' above the runway. Three or four times I asked if it had any battery left, and each time Tony would nail the throttle and steer the Radian back to a "see ya later" altitude. On his final low pass, when he accelerated again we could hear the motor cutting in and out from the low battery... but *again* it climbed to join the hawks soaring curiously overhead. This was getting ridiculous!

As near as we can guesstimate, when Tony finally slid the Radian to a stop in the grass, 60-65 minutes had passed since my hand launch. He suggests, and I agree, that with careful throttle management (climb to 500', glide back to 100', and repeat), a two-hour flight would be well within reason.

We were *all* impressed, but none more so than my good friend Porter. He came over to me, asked the price, wrote a check, and I showed him how to disassemble it and store it back in the box. Then he put it in his car and left.

Oh, and Wayne was right about the battery not being 2100 mah. It's a 1300. And one of these days when Porter brings *his* Radian out to fly, we're going to distract him somehow and slip in a 3300 mah battery. Hey, what are friends for?

Tony, Wayne, and I all have our *own* Radians now. We bought the PNP versions w/o the transmitter, receiver, and motor battery. We thus saved $90 by omitting a perfectly good $36 battery *with* charger, and a great little Spektrum DSM2 $60 5-ch receiver. Smart, huh? (Sigh.) Buy the RTF version.

-Gordon Banks
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Tony Coberly
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E-flite™
Ready To Fly
APPRENTICE
a product test report by gordon banks and tony coberly - shown by subrena laten

Model..... Apprentice 15e
Airplane Type..... RTF Electric Trainer
Manufacturer..... E-flite Models (Made in China)
Distributor..... Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price..... $421.99
Typical Street Price..... $299.99
Wing Span..... Advertised: 58"
Measured: 58.63"
Wing Area..... Advertised: 525 sq. in.
Measured: 511.3 sq. in.
Advertised Weight..... 32-35 oz. w/o btry
40-45 oz. w/btry
Airfoil..... Flat-bottom
Wing Structure..... Two-piece Z-foam
Wing Joiner Method..... Carbon fiber tube
Fuselage Structure..... One-piece Z-foam
Fuselage Length..... Advertised: 37"
Measured: 42.5"
Pushrod Type.... Steel wires in plastic guide tubes
Pushrods Installed..... Yes
Hinges Installed..... Integral with surfaces
Radio Included..... Spectrum DX5e (see text)
Recommended Controls... 4 (Ail, El, Rud, Throt)
Motor Included..... E-flite Power 15
Brushless Outrunner
Motor Mount Installed..... Yes
Motor Mount Type..... Plastic/Alum/Adjustable
Speed Controller Included.... E-flite 30 Amp BL
Motor Battery Included.... 8.68 oz. 3S 3200 mah
LiPo with a cell-balancing 12 VDC charger
Landing Gear Installed..... No
Wheels Included..... Three 1.8" foam
Assembly Instructions.. 11x8.25" booklet with 38 pages, one update sheet, and separate instructions for the E-flite 30 Amp speed controller
Hardware: Metric or SAE..... Metric
Hardware Included.... Everything required, most of which has been pre-installed
Items Needed To Complete..... Nothing
Covering Material..... None
Estimated Assembly Time..... 1 hour
Estimated Skills Required..... Beginner
Soldering Required..... None
Drilling Required..... None
Adhesives Required..... None
Assembly Tools Required. #1 Phillips screwdriver for assembly, and a #0 Phillips screwdriver if the elevator servo arm is removed for adjustment.

COMPLETED MODEL

Finished Weight w/btry..... 46.8 oz.
Wing Loading..... 13.18 oz./sq.ft.
Motor Used..... As supplied
Propeller Used..... As supplied (11x8)
Propshaft to Ground..... 6.38"
Speed Controller Used..... As supplied
Battery Used..... As supplied (8.68 oz.)
Radio Used..... As supplied
Special Items..... None

CHEERS - Superior packaging using a custom-made foam carrier to prevent shipping damage, with straps and bubble-wrap securing everything in place; totally complete kit even includes the transmitter batteries and rubber bands for the wing; includes a spread spectrum radio and a cell-balancing charger; takes under an hour to assemble; very light wing loading; surprisingly powerful motor; attractive appearance;

JEERS - Although much better than usual for E-flite, there were some issues with the instructions (see text); completed model weighs a little more (but not much) than advertised; could not achieve the recommended low and high rates (see text).

The Pre-Installed Spektrum DX5e Radio System

Transmitter..... Full range 5-ch 2.4 GHz with pre-set dual rates (see text), four servo reversing switches, one Delta-wing mixing switch, digital trims, audible low voltage warning set at 4.7 volts, LED voltage display, comes with four dry cells but has a charge jack for rechargeable batteries, trainer compatible, with a two-position ch-5 toggle switch.

Receiver..... AR500, full range, dual antenna, with dual aileron connections

Servos..... One standard size, three micro size

Instructions..... 7x10" Booklet with 24 pages

What we have here is a nicely sized basic trainer powered by an almost too-powerful E-flite Power 15 brushless motor fed by an 11.1 volt 3200 mah LiPo. The model comes from the box with everything but the wheels, stabilizers, and wing already installed, although there are some adjustments required for the recommended control surface throws. Everything required for flight is included in the box, except a 12VDC source for the battery charger. I spent less than an hour on its assembly, and another 30 minutes setting up the control surfaces (neutrals, recommended throws, etc.). There were a few minor glitches, but it was easy. Here, I'll show you what little there is to do. Note, however, that the following assembly sequence is my own, and is not as described in the instructions book.

1. Page 4, steps 1-6: Connect the supplied battery and charger to a 12 VDC power source to begin charging the battery. (2 mins)

2. Page 6, steps 1-3: Install the horizontal and vertical stabilizers using two screws and a #1 Phillips screwdriver. Be patient here, as it may take some fiddling to get the pins on the vertical stab to seat fully in the plastic sockets at the bottom of the fuselage. (1 to 5 mins)

3. Page 8, steps 4-5: Connect the elevator and rudder pushrods to the outer holes in the pre-installed control horns. (1 min)

4. Page 9, steps 1-2: Install the nose-gear. Note: I discovered that if you tighten the nose gear retaining screw, it causes excessive binding in the bearing, making the nose gear hard to turn. This leads to very poor rudder servo centering. Tighten the screw slowly just until the nose gear wire turning slack disappears, and then back the screw out 1/4 turn, leaving a tiny amount of turning slack. (1 min)

5. Page 10, step 3: Install the main gear. (1 min)

6. Page 10, step1: Look into the fuselage and make sure the servos are plugged in properly. Locate the Y-harness for the ailerons, and position the connectors where you have easy access. (1 min)

7. Using the separate addendum sheet, install the aileron pushrods. (1 min)

8. Page 11, steps 1-5 (totally ignore step 6, it's already been done, and don't do any steps after #6 until later): Assemble the wing. Do what the instructions suggest, and practice installing the self-adhesive leading and trailing edge covers before removing the backing paper. Once the adhesive makes solid contact with the wing, it cannot be removed. Position the lower lip first, and then roll the remainder of the cover into place. (2 mins)

9. Page 14, steps 1-4, and ignore step 5 for now) Go get the battery (even if it's not fully charged yet), and install it as per the instructions. *Do not* connect the connectors yet. (1 min)

10. Page 16, steps 1-5: Install the four dry cell batteries into the transmitter. (1 min)

11. Page 17, steps 1-5: Remove the spinner and propeller. (2 mins)

12. Check out the radio. First do pages 20-21, steps 1-2. Then, if using a Mode II radio, do pages 21-22, steps 3-5. If using a Mode I radio, do pages 23-24, steps 3-5. (2 mins)

13. Pages 24-28, steps 6-12, continue checking out the radio. (2 mins)

14. Now go back to page 13 and do steps 7-10 to install the wing, using all eight of the supplied rubber bands. (2 mins)

15. Temporarily install the propeller and spinner, and then check and set the CG as described on pages 28-29. Then remove the spinner and propeller again. (5 mins)

16. Perform the radio range test as described on pages 29-30, steps 1-4. (5 mins)

17. Pages 31-34, steps 1-7, check and set the control surface throws. I tried to set the recom-

mended control throws for High and Low rates, but without adjustability in the transmitter, I was unable to do so. There's only so much you can do when your only adjustment is where to connect the pushrod on the servo arm. With the pushrods already connected in the control horns' outer holes, there was no adjustment left at that end. I did the best I could and will just have to live with it. By the way, the instructions for the DX5e radio says the dual rates are 100% on high, and 50% on low. In reality, it's more like 100% on high and 70-75% on low.

18. Remove the battery and connect it to the charger again until it's fully charged.

19. Pages 34-36, re-install the spinner and propeller. (2 mins).

The Apprentice is now ready to fly as soon as the battery is charged. I'm going into the house to get rid of some old coffee and get some fresh coffee, and then I'll be right back. Why don't you read "Flying Your Apprentice" on page 30 while I'm gone.

Flying the E-flite Apprentice

Our first E-flite Apprentice was destroyed! Now that's an unusual opening line for a flight report, isn't it? Ah, but wait until you hear *how* it was destroyed, and just wait until you hear *who* did it!

First of all, it's a little hard to accept that the Apprentice has only a Power 15 motor in the nose. It is, in a word, peppy. Given full throttle on a paved runway, the Apprentice will accelerate quickly and then leap into the air like a sparrow running for its life from a hungry hawk. Given half-throttle on that same paved runway, the Apprentice rolls along and lifts off smoothly looking much like a Sunday pilot out to enjoy flying his Cessna. So let's just say that the E-flite Apprentice has enough power... and then some.

Okay, now we're flying. Keep the throttle pinned and use high rates on the control surfaces and you'd think you were flying a military trainer of some kind. It's quick, it's maneuverable, and it pretty much goes where the pilot points it. With the throttle pinned, the Apprentice is *definitely* not a super-docile (aka, boring) little trainer! It will cleanly perform a surprising number of basic maneuvers, and above all, it's fun!

Apprentice 1, Gravity 0.

But isn't the Apprentice supposed to be a RTF electric powered *trainer?* Oh yeah, that's right, it is. Sorry about that, but we were having so much fun...

Okay, back off the throttle and switch to low rates. No, back off a little more. Come on, *more*! Yeah, that's it! Somewhere around 1/4 to 1/3 throttle, add a little up-elevator trim, and the Apprentice hides the big "S" on its chest, picks up a few thick textbooks under its wing, and dons a pair of spectacles. Now it's looking more suitable to fulfil its promised academic role. Now it's poking along nice and slow, and showing signs of genuine positive stability (i.e., self-correcting tendencies) like a good trainer should. Well, maybe not quite as positive or self-correcting as the *best* primary trainers, but if you combine its slow speed with its adequate positive stability, then it makes a pretty nice trainer.

By the way, its aerobatic qualities seem more connected to air speed than control surface movement. Go fast, it performs. Go slow, it acts like a trainer.

Concerned about landing? Not with this one. I don't know, it almost seems connected to your brain or something. You can fly it right down onto the runway, and it settles smoothly for roll-out. Or you can float it in for a stall landing, and it settles smoothly for roll-out. And either way, you look good.

How good a trainer is it? Good enough for Tony to say, *"When you're finished with the review, I'll buy this one for my daughter."* And he did. And sure enough, Cassie was soon flying it all by herself.

How fun and aerobatic is it? Good enough for Tony to bring it out by himself to fly. And good enough to lead him into maneuvers so wild he finally got carried away and buried it in the weeds!

How good is it overall? Good enough for Tony to order a replacement for the one lost in the weeds.

-Gordon Banks
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Tony Coberly
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PRODUCT TEST REPORT

Item Tested..... 1/4 Scale Floats (HAN4580)
Type..... Fiberglass ARF Pontoons
Purpose..... Allow water operation
Manufacturer..... Hangar 9
Distributor..... Horizon Hobby, Inc.
4105 Fieldstone Road
Champaign, IL 61822
(877)504-0233
www.horizonhobby.com
Suggested Retail Price..... $374.99
Street Price..... $249.99
Applicability.... Designed for Hangar 9's 1/4 scale J-3 Cub ARF and PNP, but can be used on other similar-size models.
Length..... Advertised: 47.625"
Measured: 51"
Overall Width..... Advertised: 27.25"
Measured: 26.5"
Weight..... Advertised: 75-80 oz.
Measured: 93 oz. (This includes 8 oz. of required nose weight for balancing.)
Instructions..... 20 illustrated pages
Hardware Included..... Painted fiberglass floats with servo hatches, painted metal struts and fittings, wire rod cross braces with clevises, water rudder assemblies with linkages, all necessary nuts, bolts, and screws.
Items Needed To Complete.. Two standard servos, two Y-harnesses, two servo extensions, and tip weights when necessary.
Tested On..... Hangar 9 Plug-N-Play Cub
Special Test Conditions..... None

CHEERS - All parts fit as designed and are fully adjustable; can be switched from wheels to floats and back again; they look great and the plane handles fine both on the water and in the air.

JEERS - No installation instructions for use on other models; paint coverage not very even; several assembly dimensions given are inaccurate; suggested balancing procedure is incorrect; minor leaks.

I reviewed the 1/4 scale Plug-N-Play J-3 Piper Cub from Hangar 9 some time ago, but I just recently decided that I'd like to fly it off water. I contacted

Horizon Hobby about reviewing their fiberglass 1/4 scale floats, and soon thereafter the big brown airplane truck dropped off a large box at my door. I dragged it into my workshop to check the contents for shipping damage and/or missing parts, but everything was fine.

The floats are molded fiberglass complete with simulated panel lines, rivets, and other scale details. The silver paint, however, had not been applied very smoothly, and in several places there were different textures on the surfaces. It looks "okay", but it could have been better. The pre-assembled struts and braces should need only minor adjustments to have them fit perfectly. All the hardware is there to allow land-based flying or float flying, requiring only a few minutes to switch back and forth. I had to search for the screws that hold down the servo hatch covers, finally locating them inside a package of struts instead of being in the bag with the other hardware. The instructions book shows all the assembly steps required, so let's get started.

The first operation is to provide a watertight seal between the hatches and the hulls, using silicone sealer on each hatch, with wax paper between it and the float. Once the silicone cures, the hatches are removed and the excess silicone is trimmed away.

The water rudder assemblies are then mounted to the back of each float, and the pushrods with rubber sealing boots are installed. The servos that drive the rudders are installed next, and the linkages adjusted for smooth operation. This involves using a Y-harness for the receiver rudder channel, connecting one output to the rudder servo and the other output to still another Y-harness that will drive each water rudder servo through more servo extensions. I made a custom Y-harness and extensions, and made sure that the water rudder servos moved in the same direction as the airplane's rudder. The extensions will be run up one of mounting struts and plugged into the Y-harness in the fuselage.

The rubber boots on the pushrods limit the movement of the servo arms in one direction, but it all came out perfect for *this* model. When making a turn on the water, the "outside" rudder should move less than the "inside" rudder, so I adjusted the throws by offsetting the servo arms.

The strut mounting brackets, the struts, and strut braces are then installed and aligned, which takes a while, and although some of the specified lengths are close, they're not perfect, so plan on making numerous adjustments until everything is just right. One glitch in the instructions occurs when we're told to leave the screws slightly loose for now, but and then we're told to use a thread locker on the screws. Thanks, but I'll wait and use the thread locker when the screws are tightened.

The models main gear assembly must be removed, of course, but be sure to keep all the nuts and bolts for re-attachment later. Two of the necessary blind nuts are already installed in the Cub's fuselage for the rear float struts, but we have to open the holes with a sharp knife. The front and rear gear mounting brackets can stay in place, but the rears will not be used. I also removed the tail wheel assembly to reduce the amount of nose weight that might be necessary to balance the plane with the floats installed. This was not mentioned in the instructions manual, but I think it's important.

Once all the metal parts are in place, they don't look capable of even supporting their own weight, much less a 20 lb. model!

When mounting the floats to the Cub, you may need more arms and legs than you have, to hold the floats, struts, braces, and everything else in place over the upside-down fuselage. The structure became stronger and stronger as the hardware was installed and tightened, and once the brace ends were adjusted and tightened, the float assembly was solidly attached.

The servo wires run forward on the top of each float to the front struts, and then up to servo plugs I'd installed earlier. I waterproofed the plugs with shrink wrap and a dab of silicone sealer.

I then installed the wings and struts to the fuselage in preparation for balancing. The instructions suggest adding weight to the fuselage to achieve the proper CG, but this is incorrect. If balancing weight is necessary, add it to the floats so that the airplane will still be balanced when you switch back to the wheels.

My installation required 4 oz. of lead in the nose of each float. I prepared an 8 oz. mixture of 5-minute epoxy and lead shot, and poured half into the access holes in the front of each float, while the plane was supported in a vertical position. The lead and epoxy mix then settled into place in the very tip of each float. When I checked the CG again, the Cub was balanced exactly where it had been with its wheels.

Adding floats to a model adds weight, of course, but I hadn't counted on *this* much! On wheels my Cub weighed 15.5 lbs. On floats it weighs 20 lbs., and nearly a full pound heavier than the instructions indicated.

Although there are no instructions applicable to any other airplane, any enterprising modeler should be able to figure out what needs to be done. Position the step of the floats either directly below the CG or just slightly behind it. The tops of the floats should be parallel with the aerodynamic chord of the wing, and both floats should be parallel with the fuselage centerline. It may take a little engineering to accomplish this with some models, but it can be done.

Next I checked to see how long it takes to switch back and forth from floats to wheels, and found that it took me 12-14 minutes each way, depending on how many nuts and screws you drop and then have to look for.

Rick Cawley and I drove to a local lake after work one day, assembled and fueled the Cub, and

started the engine. After a radio range check, Rick took the camera and handed me the Spektrum DX7 transmitter. We carried the model to the water, and gently pushed it out onto the lake. With the Cub bobbing gently on the waves, I added a little power and found that the water rudders offer very positive directional control. I pointed the Cub's nose into the breeze, advanced the throttle, and soon the Cub lifted from the water easily and under full control. After gaining some altitude I cut the power a little and let the big Cub just cruise around. The weight of the floats adds a pendulum effect and greater positive stability, so a little more aileron input was needed to make the plane roll in either direction. The drag of the floats also requires a little more power to maintain airspeed, but the Zenoah G20EI had plenty of power for this.

I made some low, slow passes for the camera, and then climbed again for a roll. After a slight dive for more airspeed, the Cub rolled slowly, but always under complete control. It looked absolutely ridiculous, by the way, but a big Cub on floats *will* roll... eventually.

Soon it was time for the first landing. I simply cut the power a little, lined up with the intended landing area, and allowed the Cub to sink down onto the water. It bounced once and then settled onto the water nicely. The water rudders give positive steering at any significant speed, so bringing it back to the beach was easy.

That first flight used only about 1/4 of a tank of fuel, but I filled it again anyway. Now Rick took over while I used a video camera to record the action. Rick taxied out a little ways, added power slowly, and took off, saying that it needed a lot more up-elevator to lift off than he'd expected. He cruised around a few minutes and then he too tried a roll, with results very similar to mine... slow, but successful. Then he made several low and slow passes. *"Very nice... totally relaxing."*

Rick's first landing was a little smoother than mine, but he always does that. Then he said he really enjoyed the way the Cub flew, and wasn't surprised at all with the power and control with the floats attached. I felt the same way. Both flights went nicely.

We flew the Cub several more times until the sun got low and the shadows became long. I thanked Rick for his help, and headed home after a perfect day of float flying. The big Hangar 9 floats had done themselves proud.

At home I removed the servo hatch covers and found about a teaspoon of water in each hull. Since there's no such thing as a perfect seal (unless you're a hungry killer whale), I attribute the minor leak to the hatch covers. Maybe some waterproof tape will fix it.

The Hangar 9 Floats are a perfect match for their 1/4 scale Cubs, and I recommend them to anyone wanting to prepare their plane for the water quickly and easily. Floats add weight and drag to the model, so adequate power is necessary, but in this case, the Zenoah G20EI provided all the power we needed to fly, and to complete some very non-scale maneuvers!

I like the way the Cub flies on the Hangar 9 floats, so I'm likely to come back this weekend for more.

- Dick Pettit
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An old man went to a wizard to have him remove a curse he's been living with for 40 years. "I *might* be able to help," said the wizard, "but I'll need to know the *exact* words used to put the curse on you". Without hesitation the old man looked at him and said, "I now pronounce you man and wife."

PRODUCT TEST REPORT

PARK ZONE SUPER DECATHLON BL

Model.. . . . . Super Decathlon BL
Model Type. . . . RTF Fun Scale Electric Park Flyer
Manufacturer. . . . . Park Zone (Made in China)
Distributor. . . . . Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price. $199.99
Typical Street Price. $159.99
Wing Span.. . . . . Advertised: 35.4"
Measured: 35.38"
Wing Area.. . . . . Advertised: Not given
Measured: 207.74 sq. in.
Advertised Flying Weight. . . . . 16 oz.
Airfoil. . . . . Under-cambered
Wing Structure.. . . . . One-piece molded foam
Fuselage Structure. . . . . Some kind of tough foam sheet with a smooth plastic skin, plus a plastic cowl, tail fairing, and radio holder.
Fuselage Length. . . . . Advertised: 25.3"
Measured: 25.9"
Pushrod Type. . . . . Steel wires
Pushrods Installed. . . . . Yes
Hinges Installed. . . . . Yes
Radio Included. Park Zone ZX10 (FM, single stick, transmitter 3-channel, with mechanical trims and dual rates, two 3-wire micro servos, on 27 MHz
Recommended Controls. . . . . 3 (El, Rud, Throt)
Motor Included.. . . . . Park Zone 370 Brushless Outrunner
Motor Mount Installed. . Yes (integral w/fuselage)
Motor Mount Type. . . . . Plastic
Speed Controller Included. . . . E-flite 10 Amp BL
Motor Battery Included.. . . . 2-cell 800 mah LiPo
Landing Gear Installed. . . . . No, but see text
Wheels Included. . . . . 1.5" mains (tail skid)
Assembly Instructions. . . Four pages of a 20 page booklet (8.25x11"), most of which is packed with flying tips and general information about R/C, and a spare parts list, and a 4-page Quick Start Guide.
Hardware: Metric or SAE. . . . . Metric
Hardware Included. . . . . Everything required, to include batteries for the transmitter, a cell-balancing LiPo battery charger, and two props.
Items Needed To Complete. . . . . Nothing
Covering Material. . . . . Pre-finished
Estimated Assembly Time. . . . . 5 mins
Estimated Skills Required. Beginner for assembly, but some experienced for flying
Adhesives Required. . . . . None
Assembly Tools Required. #1 Phillips screwdriver

COMPLETED MODEL

Finished Weight	16.79 oz.
Wing Loading	11.64 oz./sq.ft.
Motor/ESC/Btry/Radio Used	As supplied
Propeller(s) Used	As supplied
Propshaft to Ground	7.38" (held level)

CHEERS - Very good packaging with a custom-made foam carrier to prevent shipping damage (the model can be easily disassembled and put back in the box, too!); totally complete kit includes even the dry cell transmitter batteries, as well as the motor battery and a 12 VDC cell-balancing charger; assembles in less time than it takes to read this page; assembled model has a "cute scale" appearance with pre-applied stickers and trim; plenty of power (peppier than expected); the finish provides good visibility; a fun little airplane!

JEERS - Needs a tail-wheel (even non-steerable) for better directional stability on the runway.

Park Zone's newly released Super Decathlon BL is a updated version of an earlier model. In addition to the new, yellow color, this new version has a more powerful brushless motor powered by a LiPo battery.

The Super Decathlon BL (for "brushless") is another example of what we call the "Park Zone Instant Airplanes". In all seriousness, if the distances involved were short, you could leave work at noon, drive to the hobby shop, buy a Park Zone "instant model", hook up the battery charger when you get back in your car, drive to the flying site, assemble the airplane, and get in a flight or two bef©re getting back to work by 1:00 p.m. It took me almost five whole minutes to pop the landing gear plates into their sockets, fasten the wing onto the fuselage with four rubber bands, and fasten the wing struts to the fuselage with two screws. (It's not a good one, but there's even a tiny screwdriver in the kit!) That completes the airplane, so now install the supplied eight dry cells into the transmitter, and you're done. As soon as the motor battery is charged, you're ready to fly!

FLYING THE SUPER DECATHLON BL

Without a tail wheel to hold the tail in line, this is not an easy model to fly off a runway. Once the tail skid begins to slide, all traction is lost and it likes to go sideways and ground-loop. Even a non-steerable tail wheel, pointed straight ahead, of course, would make take-offs more doable. Hand launches, on the other hand, are easy as pie. The little Decathlon has more than enough power to pull smartly away and hastily climb to an obscene altitude if you allow it. On landing, with the power off and no torque or P-factor influence, the model rolls nicely to a stop.

In flight the Decathlon is full of surprises. It's faster than expected, and offers considerably more "sportiness" than one might predict for such a little airplane. Loops and stall-turns are easy. Rolls? Did I mention that it loops well? (Remember, it has no ailerons). It also flies slowly quite well, showing a level of stability more like we'd expect from a much larger model.

A "truly great airplane"? Let's not go *that* far, but it certainly meets the basic requirements to be recommended, because the price is right, the building effort is non-existent, and it's fun to fly. For one thing it's a very good lunch-hour flier.

-Gordon Banks, glbanks@knology.net
Tony Coberly, tony@hnsinc.net

PRODUCT TEST REPORT
Hobby Zone RTF Mini-Cub

Model..... Piper Super Cub (13.5:1 scale)
Model Type.... RTF Fun Scale Electric Park Flyer with Anti-Crash Technology
Manufacturer..... Hobby Zone (Made in China)
Distributor..... Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price..... $144.99
Typical Street Price..... $119.99
Wing Span..... Advertised: 31.75"
Measured: 31.9"
Wing Area..... Advertised: Not given
Measured: 147.12 sq. in.
Advertised Flying Weight..... 7 oz.
Airfoil..... Under-cambered
Wing Structure..... One-piece molded foam
Fuselage Structure..... One-piece molded foam with a plastic cowl
Fuselage Length..... Advertised: 21.5"
Measured: 21.9"
Pushrod Type..... Steel wires in plastic tubes
Pushrods Installed..... Yes
Hinges Installed..... Yes
Recommended Controls..... 3 (El, Rud, Throt)
Radio Included..... Hobby Zone two-stick, FM, 27 MHz, 3-channel, with digital trims, a Mode I/Mode II selector switch, and a low-battery power warning buzzer.
Motor Included..... Hobby Zone 180 (brushed) integral with a gearbox
Motor Mount Installed.. Yes (integral w/fuselage)
Motor Mount Type..... Plastic
Speed Controller Included.... Yes (unspecified)
Motor Battery Included.... 2-cell 300 mah LiPo
Battery Charger Included. 12 VDC 2-cell, 300 ma cell balancing type, plus a 120 VAC adapter
Landing Gear Installed..... No, but see text
Wheels Included..... 1.25" mains, 0.7" tail
Assembly Instructions.A 4-page Quick Start Guide, and a 50-page 5.75x4" booklet covering assembly, battery charging, testing, setup, flying tips, using the Anti-Crash Technology feature, and more.
Hardware: Metric or SAE..... Metric
Hardware Included..... Everything required, to include the four dry cell batteries for the transmitter, a 12 VDC cell-balancing LiPo battery charger with an AC adapter, two propellers, and a 10-min video DVD with assembly and flying tips.
Items Needed To Complete..... Nothing
Covering Material..... Pre-finished

Estimated Assembly Time... Less than 10 minutes
Estimated Skills Required..... Beginner
Drilling Required..... None
Adhesives Required..... None
Assembly Tools Required..... None

COMPLETED MODEL

Finished Weight w/0.75 oz. btry..... 7.83 oz.
Wing Loading..... 7.66 oz./sq.ft.
Motor Used..... As supplied
Propeller Used..... As supplied
Propshaft to Ground..... 4.1" (held level)
Speed Controller Used..... As supplied
Battery Used..... As supplied
Radio Used..... As supplied
Covering/Finishing Used..... As supplied
Special Items..... None

CHEERS - Excellent packaging using a custom-made foam carrier to prevent shipping damage (the model can also be disassembled and put back in the box for storage and/or transportation); totally complete kit includes the transmitter batteries, the motor battery, and a 12 VDC cell-balancing charger with AC adapter; assembles in about five minutes; assembled model has a "cute scale" appearance with its pre-applied stickers and trim; the finishing scheme provides good visibility in flight; the Anti-Crash Technology feature really works (but see text); an easy to fly fun airplane for calm days and small flying areas.

JEERS - Spring loaded, self-centering throttle cannot be left in a power-on position; the window and windshield stickers kept coming loose until I taped them.

Yes, another little electric powered instant airplane that looks a lot like a Super Cub. This one, however, has a tail wheel that gives it good directional stability on a runway, and ACT (Anti Crash Technology) that really works. ACT has a light sensor in the windshield that looks forward and up for a bright sky. Another sensor on the bottom looks down and back for a darker ground. As long as the sensors see the brightness difference they're looking for, the pilot is in control. Throw the model into a steep dive, however, and the upper sensor will see the darker ground, while the lower sensor will see the brighter sky, and if given enough altitude to have time to work, the ACT will take over and bring the model level again. Due to the "brightness factor", we're advised not to use ACT over snow or water, and I'm guessing that it wouldn't be a good thing for night flying, either.

If you tire of the ACT, just press the right control stick inward (you'll feel and hear a 'click') to turn ACT off. Press the stick again to turn ACT back on. It always comes on when the transmitter is turned off and back on, though. Whenever ACT is turned off, the transmitter's power-on light blinks. When ACT is active on (the default condition), the light glows steadily. (Press the *left* stick inward and the transmitter beeps like crazy! Maybe this is a low-voltage warning beeper test? We'll come back to the left stick later.)

On the day of our test flights, however, the ACT did not work well due to the totally overcast sky. At times it was hardly any brighter than the ground! I've flown other Hobby Zone models with ACT on bright, sunny days, however, so I do know that it works well in the proper lighting conditions.

Assembling the Hobby Zone Min-Cub is a 'snap', and I mean that literally, because the only things we have to add, the tail wheel and main gear, both 'snap' into place. They also snap right back out so you can put everything back in the box if you want, for transportation and/or storage purposes (helps keep it clean in a dusty workshop!).

There's also a 10-min video DVD with some assembly tips, flying advice, and flying footage. It doesn't replace the instructions book though, so the video is optional, the book is not.

The Hobby Zone 180 size brushed motor with gearbox provides more than enough power for scale-like flight maneuvers for a Cub, and the little 300 mah 2-cell LiPo battery provides enough juice for at least five minutes of high-throttle flight, and nine to ten minutes of gentle cruising time (i.e., lounge chair flying).

A nice feature of the transmitter is its Mode I/Mode II selector switch. Deeply recessed so it won't be moved accidentally, this switch makes it easy to choose your desired mode of operation. However, this "nice feature" comes at a price. In either mode, the throttle stick is spring loaded and self-centering! We can't "set it and leave it" in a power-on position, so we have to constantly hold forward pressure on the stick to maintain power. I haven't taken the transmitter apart to look, so I don't know if there's a way to defeat the spring(s). What I did was jam a round toothpick into the gimbal to hold the throttle in place. Quick and dirty, but it works.

The Hobby Zone Mini Cub is fun to fly inasmuch as any easy to fly R/C airplane is fun to fly. It has no bad flight characteristics, it was super easy to assemble, it fits fully assembled into any car I know of (all but the wing fits into the trunk of my Gold Wing motorcycle!), and it's a darn good value for all that you get with it. It also handles a moderate wind far better than we expected. On this day it was fairly steady, and wasn't gusting a lot, but it was considerably stiffer than the maximum wind suggested for such models.

So here's the thing... The Hobby Zone Mini-Cub has a lot going for it in value, and it has no bad flight habits whatsoever. In fact, it was even impressive in its own way, in that it flew and performed better than expected. Other than the spring loaded throttle stick, I have no complaints with it at all. Still, there's simply nothing about flying the Mini-Cub that made it particularly endearing. Normally that might pass without notice, but in this case I keep remembering this model's bigger brother, the Hobby Zone 47" span Super Cub. That model had this inexplicable "something" that always made me look forward to flying it. And whatever that "something" was, the Mini Cub doesn't seem to have it. I like the 32" (13.5:1 scale) Hobby Zone Mini-Cub just fine, but not as much as the 47" (9.2:1 scale) version.

-Gordon Banks
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Tony Coberly
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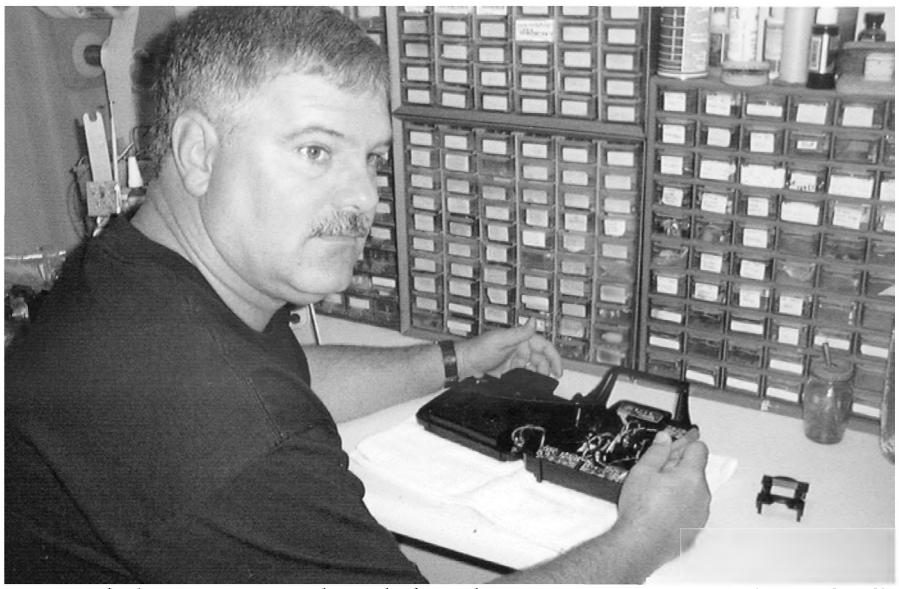
RADIO RAMBLINGS

by Tony Stillman

RADIO RAMBLINGS...
THE FINAL CHAPTER!

It's been a great ride! Due to falling revenues, however, our fearless leader has been forced into tossing in the towel for this great magazine. It is a very sorrowful day indeed, for us personally, and for R/C aeromodeling in general.

I began writing for Gordon about eight years ago when Peter Waters decided it was time to retire from writing. I want to thank Peter for giving me the opportunity to write and pass on what knowledge I have of R/C radio systems, and to help modelers get the most from their equipment.



Over the years we've looked at problem issues with all kinds of equipment. It's important to know that, just like the auto industry, the R/C systems are not perfect or without flaws. Most of the time the flaws that are found are the ones that will cause premature failure of a component or feature of the system. This may or may not be a major problem, but in virtually every case the manufacture learned from their mistakes and made the systems better when the next version came out.

My goal for our readers was to give everyone a working knowledge of how their R/C systems work, what the owner could do to get the most of the system, and to help increase the life of the components and the overall life of the system. I trust that you have learned something from my "ramblings" over the years, and will continue to follow the guidelines established by this column for the enjoyment of our favorite hobby, R/C airplanes.

Like many of you, I wish Gordon could somehow keep RCR going, but if not, I wish him well in any future endeavor that he may tackle.

Gordon, you have a *lot* to be proud of! What began as a small magazine that rose from a tabloid format to become, in my opinion, one of the very best magazines that ever hit the R/C world. The humorous way you write and edit made for a very enjoyable magazine that everyone loved. We will all miss *"R/C REPORT!"* I know everyone wishes Gordon well.

Finally, if you have a question or need some help with your radio equipment, I will still be around. You can always contact me through Radio South (see ad below). Call or write and I will do my best to help answer any R/C system questions you have.

Thanks for your support and letters over the years! Clear skies and calm winds to you all.

-Tony Stillman
139 Altama Connector, Box 322
Brunswick, GA 31525
tony@radiosouthrc.com

Brayton Paul, of Acworth, GA, holds up the Ember reviewed here. He liked it so much he bought it after seeing it fly at an RCRC electric flight event.

PRODUCT TEST REPORT

Model . . . . . Ember
Airplane Type. . RTC Electric Indoor Fun Flier
Manufacturer Park Zone Models, made in China
Distributor. . . . . Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price. $189.99
Typical Street Price. $139.99
Wing Span. . . . . Advertised: 16"
Measured: 16"
Wing Area. . . . . Advertised: Not Stated
Measured: Oops. (see text)
Advertised Weight. . . . . 0.70 oz.
Airfoil. . . . . Under-cambered
Wing Structure. . . . . One-piece foam
Wing Joiner Method. . . . . One-piece foam
Fuselage Structure. . . . . Composite open structure
Fuselage Length. . . . . Advertised: 13.5"
Measured: 13.3"
Pushrod Type. . . . . Micro steel wires
Pushrods Installed. . . . . Yes
Hinges Included. . . . . Built-in
Hinges Installed. . . . . Yes
Radio Included. . Park Zone 3-ch Spread Spectrum
Recommended Controls. . . 3 (El, Rud, and Throt)
Motor Included. . . . . Pre-installed
Motor Mount Installed. . . . . Yes
Motor Mount Type. . . . . All composite
Battery Included. . . . . Yes (1S, 70 mah, LiPo)
Landing Gear Installed. . No (and it takes a whole three to five seconds to install it, too!)
Wheels Included. . . . . Yes (main wheels only)

Assembly Instructions. . . . Good, with illustrations
Hardware: Metric or SAE. . . . . What hardware?
Hardware Included. . . . . Everything required
Items Needed To Complete. . . . . Nothing
Covering Material. . . . . None
Estimated Assembly Time. . . . Five to ten seconds
Estimated Skills Required. . . . . Beginner
Drilling Required. . . . . No
Adhesives Required. . . . . None
Assembly Tools Required. . . . . None

COMPLETED MODEL

Finished Weight. . . . . 0.68 oz.
Wing Loading. . . . . NA (see text)
Motor Used. . . . . As supplied (built-in)
Propeller Used. . . . . As supplied
Propshaft to Ground. . . . . NA (see text)
Speed Controller Used. . . . . As supplied (built-in)
Battery Used. . . . . As supplied (1-cell, 70 mah)
Radio Used. . . . . As supplied (Park Zone 3-ch Spread Spectrum)
Covering/Finishing Used. . . . As supplied (built-in)
Special Items. . . . . None

CHEERS - Totally complete and truly Ready To Fly (slide the landing gear wire into place, charge and install the battery, and fly); takes only seconds to assemble (but several minutes to charge the tiny battery); surprisingly stable and smooth flight characteristics; super easy to fly; can be flown outdoors in calm air.

JEERS - Very fragile airframe (but necessarily so)

The Park Zone "Ember" is a tiny, super light, slow flyer designed primarily for indoor flying. It's an open structure design using linear drive servos powered by two of the tiniest electric motors I've ever seen! The entire model, in fact, is an amazing piece of art, centered around a tiny circuit board that somehow includes a 2.4 GHz Spread Spectrum receiver, the speed controller, and two servo amplifiers. Taken from the box, it requires only seconds to slip the pre-assembled landing gear into place, a few seconds more to install the supplied dry cell batteries into the transmitter, and yet a few seconds more to install more dry cell batteries into the charger base. Then stick the tiny single-cell, 70 mah LiPo battery into the charger, and you're only minutes away from flying.

Use those "battery charging minutes" to inspect and admire the Ember's delicate design and assembly. It really is a fine little piece of mechanical art. Everything is so tiny and delicate, yet fully functional and flyable. It's simply amazing what tiny little craftsmen can do these days.

Okay, now the battery's charged, so it's time to fly. We were outside, but the air was so calm, you could drop a ping pong ball from 500' and it would fall straight as a shadow. I tossed the Ember into the almost something like what may have been a breeze that might best be called a "whisper", and watched it climb away with authority. Trimming it for straight and level flight at maybe 2/3 throttle required two clicks of right rudder, but then it was floating around like a male feather looking for a landing spot, but refusing to ask directions. I flew it thataway for a few seconds, and then turned back to make a slow fly by. Or was it a high-speed pass? It's really hard to tell the difference. Adding more throttle made it climb, but I'll be darned if I could tell if it was going any faster!

The Ember is not exciting to fly because of any high performance factors, it was fun because it was so incredibly slow, and because of all the complaints from spectators, like *"Hey! Slow that thing down!"*, and *"Good grief that thing's loud!"*, and *"Someone swat that big mosquito!"*

How slow is the Ember, and how calm was the air that day? Guys, this is the first, and likely the last, R/C model that I was able to fly and photograph in flight at the same time! Why was I doing both, instead of asking Tony to handle the maiden flight? Hey, I *offered* to let Tony fly it, but quickly withdrew that offer when he suggested, *"Let's try a 4-cell battery in it! That should make a hot Ember!"* (I apologize for Tony, folks, but I think maybe he played around with wall sockets as a child.)

Tiny indoor models are not among my favorites, but the Ember *was* fun to fly, and it must have been pretty impressive to at least one other person as well. After seeing it fly at the Rocket City Radio Controllers' electric fly in, Drayton Paul (AMA #686!), a visitor from Acworth, GA, wanted to buy it. He handed me the cash (good indoors and outdoors), and I handed him the Ember. It was sold before I even remembered to determine its actual wing area! (Sorry about that!)

The Park Zone RTF Ember isn't "hot" like a fire ember, but for pocket-size fun, it sure glows brightly. It even fits, fully assembled, into almost any car! (In the glove box, I mean.) Now there are two newer versions of the Ember available, so if you're an indoor flier, check 'em out and see which one is best for you.

-Gordon Banks
glbanks@knology.net

GREAT PLANES®

SUKHOI SU-31

PERFORMANCE SERIES ARF

a product test report
by dick pettit

graphics by heather cellura

Model Reviewed. . . . . 25% Sukhoi SU-31 Performance Series ARF
Airplane Type. . . . . Giant Sport Scale Aerobatic
Manufacturer. . . . . Great Planes Model Mfg. Co.
3002 N. Apollo Dr.
Suite #1
Champaign, IL 61822
(217)398-8970
www.greatplanes.com
Distributor. . . . . Dealers or direct
Suggested Retail Price. $429.99
Wing Span. . . . . Advertised: 77"
Measured: 77"
Wing Area. . . . . Advertised: 1155 sq.in.
Measured: 1130 sq.in.
Advertised Weight. . . . . 13-15 lbs.
Airfoil. . . . . Symmetrical
Wing Structure. . . . Balsa, plywood, and hardwood
Wing Joiner Method. . . . Aluminum joiners w/ply backing
Fuselage Structure. . . . . Balsa, plywood, and foam
Fuselage Length. . . . . Advertised -70"
Measured - 68"
Pushrod Type. . . . . 4-40 rods and clevises
Pull-pull option on rudder
Pushrods Installed. . . . . No
Hinges Included. . . . . Yes, point style
Hinges Installed. . . . . No
Radio Included. . . . . No
Radio Pre-installed. . . . . No
Recommended Controls. . . 4 (Ail, El, Rud, Throt)
Engine Included. . . . . No
Engine Mount Installed. . . . . No
Engine Mount Type. . . . . Plastic, adjustable
Recommended Engine. . . . . 1.6-1.8 c.i. 2C, 1.8-2.1 c.i. 4C, 1.9-2.6 c.i. gas, or 63-62-250 Rimfire Electric
Fuel Tank Included. . . . Yes, 25 oz., (739cc) glow fuel compatible only
Recommended Fuel Tank. . . . . As supplied
Landing Gear Installed. . . . . No
Wheels Included. . . . . Yes, 4" foam main, 1" tail
Recommended Wheels. . . . . As supplied
Assembly Instructions. . . . . 52 illustrated pages
Hardware: Metric or SAE. . . . . SAE
Hardware Included. . . . . Painted fiberglass cowl and wheel pants, formed plastic canopy, painted aluminum main landing gear legs, wheels, axles, collars, metal spinner with hardware, spring type tail wheel assembly, plastic adjustable engine mount, all necessary control linkage materials, all required nuts, bolts, and screws, and self-stick graphics sheet.
Items Needed To Complete. . . . . Engine, prop, mount (gas or electric only), gas compatible tank stopper and fuel tubing (gas engine only), 4-ch radio system with six HD standard size servos, and one standard servo.
Covering Material. . . . . Top Flite Monokote
Drilling Required. Yes, engine and servo mounting
Fuel Proofing Required. . . . Yes, at cut and drilled locations
Estimated Assembly Time. . . . . 20 hours
Estimated Skills Required. . . . . Advanced
Assembly Tools Required. . Basic hobby tools plus electric drill with assorted bits, high speed rotary tool with cut-off wheels and sanding drums.
Adhesives Required. . . . . Epoxy, instant adhesives, Hing glue, and Canopy glue.

COMPLETED MODEL

Finished Weight..... 14 lbs. 2 oz.(226 oz.)
Wing Loading..... 28.8 oz./sq.ft.
Engine Used..... Fuji BT-43EI-2 (63.9 oz.)
Propeller Used..... APC 20x8
Propshaft to Ground..... 13" (held level)
Fuel Tank Used..... As supplied
Radio Used..... Futaba 9CAP w/FASST module and 7-ch receiver, six Futaba S3305 HD servos, one Futaba 3001 servo, Radical R/C 5-cell 1650 mah NiMH receiver battery, 4-cell 1650 mah NiMH ignition battery, and two Radical R/C HD charge switches.
Covering/Finishing Used..... Top Flite Monokote (Five colors)
Special Items.. DuBro gas compatible tank stopper, fuel lines, Fill-It fueling port and HD servo arms, Great Planes 25% pilot figure, and Tru-Turn low profile spinner adapter.

CHEERS - Very complete kit; all parts suitable for a model of this type and size; very quick and easy assembly; excellent aerobatic flight capability; good 3D performance.

JEERS - No gas engine mounting hardware; covering reacted to heat differently than Monokote; recommended servo arms didn't fit recommended servos; top hatch mounting suggestion very sloppy; prop bolts with Fuji 43 engine not long enough to work with spinner backplate.

"The Sukhoi SU-31 is the latest single seater from Sukhoi and its devastating performance was used to win the Breitling Championship in the hands of Yurgis Kairis. It has the highest performance of any piston engined aircraft made today, and as well as being flown by members of the Russian aerobatic team, has, since it became commercially available at the end of 1994 been ordered by the 1994 World Aerobatic Champion, Xavier de Lapparent, as well as the then current Swiss, French, Italian, Spanish, Australian and South African champions."

"Although the SU-31 is physically similar to the SU-26, it is actually really quite different. The main difference being that the entire fuselage, i.e. everything behind the cockpit, is composite rather than tubular steel. This reduces the weight by some 30kgs, which is very significant in an aircraft of this sort."

"In terms of flying qualities, the SU-31 is designed to be somewhat more unstable than the SU-26, although this is only really a matter of degree and this makes it much more suitable for free-style flying, and certainly a great deal easier to snap-roll than the SU-26."

"Like all other Sukhois, the SU-31 can use either the 360hp M14P or the 400hp M14PF, although as a practicality more aircraft have the more powerful engine fitted."

"The SU-31 has continued the extraordinary competition track record of the SU-26, winning successive World and European championships in both men's and women's categories."

When I found out one of the Great Planes 25% scale Sukhoi ARF's was being sent to me, I did some research on the internet for some background information on the full scale plane. I then noticed that the wing span of the model was only 77" and the wing span of the full scale Sukhoi was 27', making the model a bit smaller that 25% scale. Since I wanted to participate in IMAA events, I did some more research and found out that the latest model of the SU-31 has a wing span of 25', making the model a bit larger than 25% scale. With that out of the way, I eagerly anticipated the delivery of the Great Planes Sukhoi SU-31.

When the shipping box arrived at the shop, I immediately opened it and was marveled at the details and quality of the parts inside. The fuselage is made from laser cut balsa and plywood parts with balsa sheeted foam used on the turtle deck and the canopy hatch. The wings are also made from laser cut wood and have an open framework construction. The painted fiberglass cowl and wheel pants look really nice, and the rest of the plane was covered with Top Flite Monokote. While no wrinkles were visible at first, I'll still run a heat gun over everything to see what shows up. Also included was a pair of painted metal main landing gear legs, some 4" foam wheels, a nice formed canopy, a number of bags of hardware, and even a set of laser cut wood parts to line the cowl up with the engine. I almost forgot to mention the high quality instructions manual (which is typical from Great Planes), and a sheet of self-stick graphics.

The Great Planes Sukhoi SU-31 has several power options the builder can choose from. I'll be using a Fuji BT-43EI-2 gas ignition engine, mainly because of my familiarity with the operation of these engines. They provide lots of power, they're relatively light weight, and they're also very economical in operation. Other choices include 2C or 4C glow engines, plus a number of high-power electric motor and battery combinations. The instructions cover these power choices, but the ultimate decision is left to the builder.

I'll be using Pacer adhesives to assemble the Great Planes Sukhoi SU-31, including their epoxies, Zap instant adhesives, and Hinge Glue. With these adhe-

sives, and many others you may use, please provide proper ventilation during their use. Also make sure that proper ventilation is used when cutting and sanding fiberglass parts such as the cowl and wheel pants.

The first thing to do is use a heat gun and a soft cloth over the MonoKote. Any areas not tightly bonded to the wooden surfaces will bubble up, much like the wrinkles we see after a new plane is left in the hot sun a while. It's better to get rid of them at the workshop rather than trying to show off a new model that looks like grandma's stockings. The covering reacted differently to heat than how I remember MonoKote. The covering used here is said to be MonoKote, but I'll have to check it with Great Planes. Be very careful when applying heat to the edges of trim pieces or on parts of the covering that have been overlapped. Whatever the covering material is, I rate its application on the Great Planes Sukhoi SU-31 to be very good.

As usual, the next item of business is the installation of the ailerons to the wing panels. This step also includes the servo installation and installing the associated linkages. The Sukhoi uses point style hinges that fit nicely into pre-drilled holes. Rather than using epoxy to secure the hinges, I used Pacer hinge glue, which has always worked perfectly for me. Pacer hinge glue is water based, which makes it easier to clean up if a little is dribbled on the covering. Be extra careful when squirting the glue into the hinge holes because it can go all the way through and drip on the inside of the covering. I always apply glue to the wing holes first, insert the hinges, and place the wing with the hinges pointing down to keep the glue from dribbling back into the wings interior. When the glue has cured, usually overnight, the aileron is then installed with the trailing edge pointed up for the very same reason. I'm using the same servos recommended in the instructions, Futaba S3305 Ball Bearing Metal Gear units with 124 oz./in. at 6 volts. I also plan to use the recommended Great Planes long servo arms that can be used on any popular modern servo. There's a plastic insert for Hitec, JR, and Futaba splines that allow this to be done. However, when I tried to replace the stock Futaba arm with the new Great Planes arm, the servo shaft screw hole was too small. I know I could have drilled it larger, but since the instructions recommend both of these servos and these arms, and that they don't fit one another, I'll have to mark it as a "Jeer" and use something else.

I chose to use DuBro Heavy Duty long servo arms for an additional servo throw. I soldered some servo extensions and terminated them at the root with locking connectors. The servos were installed in the traditional manner and the linkages were assembled using 4-40 rods and clevises supplied in the kit. Be sure to use the locking nuts on the threaded end of the rods and also use the fuel tubing clevis keepers on all clevises. Since the servos have metal gears, a drop of thread locker on the servo shaft screw won't hurt anything.

Once this was done, the wing panels are joined using a laminated dihedral brace and Pacer epoxy. The brace is made from two pieces of laser cut plywood and two pieces of aluminum that are epoxied together and allowed to cure. Be sure to scratch the surface of the aluminum parts to give the epoxy something to grab on to. When the brace is cured, check how it fits in the wing pockets, sanding only where it's a very tight fit. Once satisfied with the fit of the brace and of the wing root ribs, some 30-min epoxy is mixed and liberally swabbed ☺n all mating surfaces. I applied a few pieces of masking tape on the root ends of the wings so any excess epoxy can be easily removed. I pushed the wing panels together with the dihedral brace in place and allowed it to cure.

The wing is now ready to install on the fuselage after a pair of dowels are glued to the leading edge and bolt holes are opened in the covering. There's also a bolt backup plate that is glued to the underside of the wing to keep the nylon bolts from digging into the balsa sheeting. The bottom wing cover will be added later.

The stabilizer, the elevators, and the rudder are to be added next, but I jumped ahead and installed the main landing gear legs, wheels, wheel pants, and tail wheel assembly. Everything fit exactly as it was supposed to and the wheels turn freely inside the wheel pants. The main gear cover is glued to the fuselage opening with a few dabs of silicone sealer in case it needs to be removed at a later time.

After removing the covering from the stab and the servo slots, with a hot soldering iron tip, the stab is checked for fit, aligned to be level, equidistant to the wing, and epoxied into place. No sanding or adjustments were needed to attain perfect alignment. The elevators are hinged into place in the same manner as the ailerons and the rudder is added too. The servo linkages and control horns are installed for the elevators, but not for the rudder. This is because the builder is given the option of placing the rudder servos either at the tail when using heavier engines or under the wing area when using lighter engines.

The instructions give the builder three options for engine installation, 2C glow, gas power, and

electric power. An adjustable engine mount is provided along with the mounting hardware for the glow engine, but nothing is provided for the other options. The Fuji BT-43EI-2 gas engine simply bolts to the firewall after marking and drilling the mounting holes. I chose to use bolts and blind nuts to hold the engine in place and added the ball link to the throttle arm. The throttle servo and linkage were installed in one of the openings that could be occupied by a front mounted rudder servo. I took a close look at the other engine installation options and each seemed to be straightforward and easy to complete.

The huge fiberglass cowl is mounted next using a set of plywood disks that are zapped together and bolted to the front of the engine. This disk arrangement fits inside the cowl and aligns it to be centered with the engine prop shaft and it also allows
proper spacing between the spinner backplate and the cowl. The openings for the muffler pipes and the spark plug boot must be cut before final alignment is possible. The wooden blocks must be installed precisely since there are molded louvers in the cowl that prevent mounting bolt holes from being drilled at those locations. The blocks are epoxied to the firewall and are then pinned using hardwood dowels and wood glue to keep the blocks in place. The cowl is then drilled for the mounting screws and the cowl installation is complete.

The Sukhoi comes with a really nice metal spinner with a few adapter spacers and spinner bolts, and is supposed to be used with the prop bolt that comes with the Fuji BT-43EI-2 engine. I ran into a severe problem when I tried to mount the prop and the spinner backplate because there weren't enough threads to screw into the engine. The other prop bolt supplied was not drilled and tapped for the spinner bolt. I emailed Tru-Turn asking if a prop bolt or adapter was available for the Fuji 43. Sure enough, in a few days the correct bolt arrived, it fit just fine and solved the problem completely. Please don't be tempted to use either of the prop bolts with the spinner backplate on the Sukhoi that comes with the Fuji 43 because there are not enough threads to hold the prop on tightly.

The ignition box and its battery mount on a plywood tray that sits on top of the motor box. Hook and loop fasteners hold everything in place and the ignition charge switch can be mounted to the side of the firewall on a small mounting bracket. But this installation requires a large hole in the side of the cowl to allow the power switch operation. I mounted the switch assembly on the side of the fuselage behind the firewall.

The top hatch is mounted next and I found that the front mounting bolt holes were inset from the outer skin of the fuselage, making for a very sloppy installation. I added some balsa and plywood pieces between the inner part of the fuselage and the hatch mounting tabs and now the front bolts tighten against the outside of the fuselage, just like the rear bolts. I used a Great Planes 25% pilot figure but I did not have to cut part of the bottom of the figure off as mentioned in the instructions. The instrument panel sticker was added and the plastic canopy was screwed into place completing the installation of the hatch.

All that's left, as far as assembly, is to glue the bottom wing fairing to the underside of the wing while it's mounted to the fuselage. I used yellow carpenter glue since we were gluing foam to uncovered balsa, and allowed it to dry overnight with several weights holding it down.

I mounted the receiver, a Futaba FASST system 7-ch R607FS unit, to the rear mounted radio tray. There are a number of optional trays and mounting locations, depending on engine and balance arrangements, the receiver I'm using fit perfectly. I mounted the 5-cell 1650 mah NiMH battery and the charge switch in an appropriate location. After I routed the servo leads to the receiver, the radio installation was complete.

With everything completely assembled, I checked the weight and balance of the Sukhoi, finding that it actually balanced at the center of the balancing range stated in the instructions. The total weight was 14 lbs., 2 oz., right in the middle of the stated weight range. After adjusting the control throws according to the manual (they were right so far) I took the plane outside to test run the engine. The Fuji 43 started almost immediately, and after a short warmup, I checked the high and low speed mixture adjustments. There seemed to be plenty of thrust since the Sukhoi would lift vertically out of my grasp at less than full throttle. Taxiing on both the grass and the street showed me that just about everything was ready to take to the field and do some flying.

It was promising to be a warm October afternoon and the Sukhoi looked beautiful in the bright sunshine. After taking the required ground photos, I filled the gas tank, started the engine, and made a power-on radio range check with my new Futaba FASST module equipped transmitter and receiver. No problems were found, so I taxied the Sukhoi to the upwind end of the runway, pointed the nose in the right direction, and advanced the throttle slightly. The plane

began moving faster and faster, and with just a little up elevator, it was airborne, using only about 1/3 throttle. After trimming, which wasn't more than a click of down elevator, the Sukhoi responded to the aileron movement quickly and smoothly. I had to look at the transmitter to see if I put the aileron dual rate switch on the high position because the Sukhoi seemed to roll very quickly. Nope, this was all on low rates, so I planned to take it easy for the moment.

Rolls were axial, loops were as big or as small as I wanted, and all the other standard aerobatic maneuvers I attempted looked smooth and stable. I did a two-turn spin and it stopped spinning when the controls were relaxed. I had only planned to fly basic and advanced aerobatic maneuvers at this flying session, saving the all-out 3D flying for the following week at a local flying event. I made a few more low and slow passes for the spectators, and then pointed the nose straight up, pushed the throttle to full power and the Sukhoi headed for the clouds without any hesitation. Just for good measure, I rolled the Sukhoi a few times on the way up, but those rolls didn't seem to impede the progress of the Sukhoi at all. It looks like the Fuji 43 is a very good power source for this particular plane.

After I could see the plane again, I set up for a landing, which turned out to be a bit long but otherwise uneventful. I taxied the plane to the pit area, stopped the engine, and answered the many questions that the spectators were asking. With the gas tank refilled and after a brief inspection for loose or missing parts, the Fuji 43 was started (on the very first flip I might add) I handed the transmitter over to my ass©ciate test pilot, Rick Cawley, for him to fly and for me to take some more photos.

After taking off at low power, Rick proceeded to roll the Sukhoi at both low speed and low altitude, which looked great, but worried me just a little. Later he said that it looked so good in the air when I was flying it, he knew that a low and slow roll would be nothing out of the ordinary. He then flew around, back and forth, up and down, asking the Sukhoi to do all sorts of basic and intermediate aerobatic maneuvers, to which the plane responded exactly as asked. When full power was added and the nose raised to vertical, Rick rolled the Sukhoi several times, then cranked in a few snap rolls just to be sure that I saw them. He later commented that inverted flight needed practically no down elevator and that knife edge flight needed only a bit of elevator to keep on track.

After landing, Rick said that everything he asked the Sukhoi to do, it responded immediately and precisely, just as I had stated before. He agreed that the Fuji 43EI engine was a really good choice for this particular plane at this weight, but also said that many modelers may want to use one of the many other engine choices out there. We both said that they should at least give the Fuji 43 a chance to prove itself.

After the test flying session was over, I made plans to attend a local IMAA flying event the following weekend to see how the Great Planes Sukhoi performed under the skillful guidance of a more experienced 3D pilot. I watched several pilots fly the Sukhoi for the first time that day, and I was very impressed in the way the plane responded to their commands. While not quite as stable as a larger 3D model, the Great Planes Sukhoi could hold its own in practically every maneuver. Harrier maneuvers were a little on the "rocky" side, mostly due to the small size and lighter weight of this particular model. Rolling Circles were easy to synchronize with the transmitter and looked really good. Flat Spins, both upright and inverted, were easy to enter and exit, but a rearward CG may help keep them flatter. There was enough excess power to pull the Sukhoi out of a sustained hover at a good rate of speed. Torque Rolls looked really nice, but again were a little shaky due to the relative small size of the model. One pilot even tried a Blender, after my initial objection, but it resulted in a really nice outcome, considering that it was started at a rather low altitude. In all, when under the control of an experienced 3D pilot, the Great Planes Sukhoi SU-31 can be competitive in practically all phases of IMAC competition, but at the other end of the spectrum, it could be used as an educational tool to bring the average pilot with a limited budget up to the competition level in no time.

The Great Planes 25% Sukhoi SU-31 Performance Series ARF is easy to assemble, it requires only slightly larger than standard servos and engine, it's a reasonable size to transport and store, and it looks great on the ground and in the air. There were some minor problems while assembling the Sukhoi, but none were insurmountable. The recommended Fuji BT-43EI-2 engine starts and runs great, it provides more than enough power for most aerobatic and 3D flying, and it's reasonably priced.

I recommend this model to intermediate pilots entering the IMAC arena, for learning scale aerobatics. Toss in some all-out 3D stuff too, because the Sukhoi can definitely handle it.

-Dick Pettit
pettit@ti.com

SPARKY'S REVOLT

by Tony Coberly

(Editor's Note: The following discussion deals with a subject that not all modelers know about., so here's a quick primer: We typically use a 4-cell (4.8 volts) or 5-cell (6.0 volts) NiCd or NiMh battery to power our radio system. Everyone in R/C understands that. But with today's high-density lithium batteries weighing so much less than nickle batteries, and providing so much more power, many modelers want to use a lighter or more powerful lithium battery to power their radio system. But, a single-cell LiPo battery produces only 3.7 volts, which isn't enough, so we'll need more than one cell. A 2-cell LiPo, however, has an output of at least 7.4 volts, which is too much voltage for most radio systems. So how can we take advantage of the lithium battery's advantages? We install a voltage regulator between the On/Off switch and the receiver (not between the switch and the battery). Then, depending on the voltage regulator we choose, we can often use batteries of two, three, four, and even five cells or more. The Radio South 10 Amp voltage regulators I use allow an input up to 30 volts!)

Hello all. It will soon be spring again and the new year's flying weather is just around the corner for most areas of the country. This month I'm going to address an issue that was posed recently by a friend of mine, former AMA president, Don Lowe. He sent me the following email...

"Hi, Tony. I thought it would be worthwhile to tell members about a strange phenomena I've wrestled with lately. A friend of mine, Tony Do, has a QQ Yak powered by a DA50. In flight the aircraft would fly normally for a short time, but then the engine shuts down, consistently. Every flight ended in a dead stick landing. We tried everything including carb cleaning, ignition battery change, wiring and switch change, ignition unit change, plumbing change, etc. I finally ran a check on the control system battery (lithium) while under load, and guess what? With a 1.5 Amp load, the regulator output was only about 4.3 volts, which is below the voltage at which the Futaba receiver gives a warning that the battery is too low (it retards the throttle). With Tony's setup, that built-in warning apparently pulled the throttle all the way back to engine cutoff. A check with my regulator, which is set for 6.1 volts, was okay. Our solution was to replace the lithium battery with a 6 volt NiMh battery without a regulator. Apparently some regulators will not hold the stated output voltage under a heavy load. I've used a 6 volt battery for many years (no regulator). It provides more servo torque, faster servo speed, better servo resolution, and a safer voltage margin to help prevent strange occurrences such as the one I've just described. You might be surprised at the very high current drain in some models with vibrating engines and tight digital servos. The radio system's drain on the battery is much higher when the engine is running and vibrating the airframe, than when the engine is shut off. Just thought you might want to know." Don Lowe

Wow! This really perked my interest because I've seen something similar with a foamy biplane using four servos. A Battery Eliminator Circuit (BEC) is just a switching regulator that provides radio system voltage from our motor battery. The BEC circuits today are usually rated at 1.5 to 3.0 Amps. Depending on the ESC's manufacturer, the BEC circuit will usually overheat and shut down if the maximum rated current is exceeded. While this "shut down" will usually save the ESC from

internal damage, it usually results in a crash, since we no longer have radio control! This is exactly what happened with the little foamy bipe, but luck was on our side that day, and the circuit reset itself just in time to save the model.

The foamy's four servos pulled 1.5 Amps just to hold center, so when flying the current would spike to over 3.0 Amps! There was nothing I could do about the high current since the plane needs the servos. Our only option was to add a regulator capable of *more* than 3.0 Amps. Castle Creations offers a BEC Switching Regulator capable of handling a peak current of 10 Amps, and a continuous current of 7 Amps with 12 volt input. This regulator is smaller than a postage stamp, weighs only 11 grams (0.4 oz.), and its output voltage can be adjusted with the Castle Link USB adapter for a computer. This is a nice little setup that works very well.

Now let's take a closer look at the problem Don described. Using a lithium battery with a voltage regulator in a larger plane to help reduce weight is becoming routine. We must ensure that out regulator is up to the task, however. In Don's case, the output voltage from the regulator dropped to 4.3 volts under a 1.5 Amp load. Frankly, I suspect a faulty voltage regulator. I have a BEC that will maintain a full 5.1 volts output even at 5 Amps.

How was the regulator damaged? That's hard to say, but I do know that we have to choose the right regulator for our airplane. My CC BEC is a good choice for larger electric planes simply because that's what it was designed for. I used one in my E-flite "Deuces Wild" and have had no problems, but I'd recommend something even more robust for glow or gas powered planes.

What is "more robust"? My recommendation for glow powered planes would be the Radio South voltage regulator. I've been using one in my two-meter pattern planes for years and have never had a problem with it. This regulator is capable of an output similar to the CC BEC, but the Radio South unit has a larger heat sink and was *designed* for planes in the two-meter size range. Radio South regulators are available with output voltages of 5.0, 5.6, 5.8, and 6.1.

Finally, the most robust regulator I have ever used (and highly recommend) is from MAXX Products Int. (see pages 10-11). This 6.0 volt regulator is different from the switching regulators already mentioned. This one is a *linear* regulator that will provide a whopping 15 Amp continuous, and 30 Amp peak current flow. Linear regulators are considerably larger than switching regulators however, due in part to its much larger heat to handle the higher current capacities. I recommend regulators like this for those big planes using engines of 50cc and more.

Now, one more thing about using voltage regulators. When we check our flight pack batteries we usually plug the tester into the charging jack of our receiver switch to read the battery voltage. There's nothing wrong with that, but as Don mentioned above, the battery voltage was fine, but the regulator's output was weak. Whenever using a regulator in a basic setup, make sure the power switch is between the battery and the regulator. The electronics in the regulator draw a little current all the time, so if the two are left connected, we can wind up with a dead lithium battery. Plus, you can't charge the battery through a voltage regulator, so the charge-switch has to be connected directly to the battery.

There are some voltage regulator power systems with built-in fail safe switches and the like, but I'm only talking about regulators added into a radio system between the battery and receiver. Typically, we have first the oversize battery, then the On/Off switch harness, then the voltage regulator, and then the receiver, in that order. This is a good basic setup that will allow us to test our battery voltage between flights, but how will we test the output of the regulator? We could add another charging switch harness between the regulator and receiver, but I don't really like adding another mechanical device to the mix. I prefer adding a servo extension lead to an unused channel of the receiver (or a Y-harness to share a receiver connector). This gives me a way to plug in my battery tester while the power is turned on, to see the actual voltage at the receiver. If this voltage is more or less than it should be, I'll know to suspect a problem with the regulator.

By now you know that this is *"R/C REPORT'S"* final issue. I want to thank Gordon for allowing me into the RCR family, and for editing my articles to make them readable. I've never thought of myself as a writer (and I still don't), but I appreciate the opportunity to provide information that hopefully has or will help modelers new to electrics. I'd also like to thank all you readers for your comments, suggestions, and corrections. Keep my addresses handy if you like, because I'll always be happy to assist anyone with modeling questions.

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PRODUCT TEST REPORT
ELECTRIFLY SOPWITH CAMEL

Model.. Sopwith Camel (GPMA1144)
Airplane Type.. Fun Scale Electric Park Flyer
Manufacturer.. Electrify (Made in China)
Distributor.. Great Planes Model Mfg. Co.
P.O. Box 9021
Champaign, IL 61826-9021
(217)398-3630
www.greatplanes.com
Typical Street Price.. $99.99
Wing Span.. Advertised: 35.5"
Measured: Top: 35.25", Bot: 36"
Wing Area.. Advertised: 389 sq. in.
Measured: Top: 192.16 sq. in., Bot: 199.4 sq.in.
Total: 391.56 sq.in
Advertised Flying Weight.. 21 to 26 oz.
Airfoil.. Flat-bottom
Wing Structure.. Built-up plywood and balsa
Wing Joiner Method.. One-piece wings
Fuselage Structure.. Built-up plywood and balsa
Fuselage Length.. Advertised: 25"
Measured: 25.25" w/spinner
Pushrod Type.. Steel wires in plastic tubes
Pushrods Installed.. No
Hinges Included.. CA-type
Hinges Installed.. All but one
Recommended Controls.. 4 (Ail, El, Rud, Throt)
Motor Included.. No
Recommended Motor. Electrify Rimfire 28-30-950 Brushless Outrunner
Motor Mount Installed.. No
Motor Mount Type.. Aluminum tube spacers
Speed Controller Included.. No
Recommended Controller.. 25 Amp Brushless
Battery Included.. No
Recommended Battery.. 3S 1500 mah LiPo
Landing Gear Installed.. No
Wheels Included.. Two 3" mains (tail skid)
Assembly Instructions.. 20 pages (8.5x11")
Hardware: Metric or SAE.. Mixed
Hardware Included.. Pre-painted plastic cowl with built-in magnetic mounting ring; pre-painted dummy radial engine with additional scale details (see text); fiberglass motor mount with aluminum tube spacers and mounting screws; pre-formed plastic battery compartment hatch with magnets; two plastic machine guns; one pre-painted pilot figure with neck scarf; clear plastic windscreen for cockpit; two 3" scale wheels with rubber tires; pre-formed strut pieces; main axle tube; numerous pre-cut plywood pieces; plastic scale-detail inspection panels; a small red aluminum spinner; one 4" length of 3/4" wide Velcro; all

Now who's to say this isn't a giant scale model?

necessary pushrod materials and control horns; a 0.9mm hex wrench for the EZ connectors (don't lose this!), and lots of miscellaneous nuts 'n bolts.

Items Needed To Complete. Propeller, appropriate power system (motor, speed controller, and battery), 4-ch radio system with four micro (17 oz. torque minimum) servos; two 8" servo extension and one 6" Y-harness (all for the ailerons).

Covering Material. . . . . MonoKote
Estimated Skills Required. . . . . Experienced (for assembly and flying)
Drilling Required. . . . . Yes
Soldering Required. . . . . Likely, but depends on equipment used
Painting Required. . . . . Optional only
Adhesives Required. . . . . Thick and thin CA, and thread-locker for screws
Assembly Tools Required. . . . . Typical modeling tools and masking tape
Assembly Time. . . . . Approx 15 hours

COMPLETED MODEL

Flying Weight w/4.6 oz. btry. . . . . 23.98 oz.
Wing Loading. . . . . 8.82 oz./sq.ft.
Motor Used. Electrify Rimfire 28-30-950 Brushless Outrunner (GPMG4560, 2 oz., 155 Watts, $40)
Propeller(s) Used. 10x4.5 (Electrify GPMQ6660)
Propshaft to Ground. . . . . 6" (held level)
Speed Controller Used. . . . . Electrify Silver Series 25 Amp Brushless ESC w/BEC (GPMM1820, 1.0 oz., $40)
ESC to Motor Wiring Adapters. . . 2mm female to 3.5mm male (Electrify GPMM3122, $5.49)
Battery Used. . . . . Electrify 3S 1500 mah LiPo (GPMP0717, 4.6 oz., $27.99)
Radio Used. . . . . Futaba 10C transmitter, R617FS FASST receiver, four Futaba S3114 micro servos., one 6" Y-harness, and two 7" servo extension.
Covering/Finishing Used. . . . . Comes pre-covered
Special Items. . . . . None

CHEERS - A superb basic design backed up with beautiful workmanship; kit includes a *lot* of hardware, to include a surprising number of unexpected scale details (see text); the completed model is very attractive in the air and in the pits; excellent flight characteristics; an extremely nice little electric scale model at a very attractive price.

JEERS - Recommended motor and ESC require wiring adapters to be compatible; some instructions steps are brief and/or vague, and some should be more descriptive of the parts being used; non-adjustable aileron pushrods essentially make the wings non-removable once the mode is fully assembled (see text).

Straight from the box, the wrinkle-free covering on this model was among the best I've ever seen. After a few days in the Alabama humidity, some wrinkles did show up, but I still rate it better than average.

I'm particularly tickled (say *that* ten times real fast!) at the number of scale details included with the Camel for such a small model! The pre-painted model bust with the appropriate leather helmet and goggles, the miniature machine guns, the side-mounted inspection panels with simulated rivets, the non-de-

Access to the battery is easy, but actually connecting and disconnecting the battery is tedious for big hands in the limited space under the wing.

tailed but scale-shape wheels, and best of all, the nicely detailed 9-cylinder dummy engine with optional pushrod tubes! Guys, we've seen giant scale models with less detail than this! I mean, we're not talking Top Gun here, but it's still very nice.

The covering work, the parts fit, and the pre-assembly work done at the factory are simply excellent. Except for the cowl, no parts trimming or unusual adjustments were required, other than enlarging servo arm holes to accept the appropriate hardware.

Now, for the benefit of those who decide to assemble their own Electrifly Sopwith Camel, here are just a few assembly notes:

The Camel's instructions are pretty good overall, but to me there are some oddly sequenced steps (I don't like to install the tail before installing the other fuselage parts), and some are a bit short on describing the parts (mostly which screws) to be used in that step. Since this kit is not recommended for inexperienced modelers anyway, I suggest using the instructions as a guide, and use your own experience and personal preferences as to when you complete each step. Still, I recommend completing step 4 on page 8 (install the rudder and elevator servos using the last picture on page 8 as a positioning guide) through step 3 on page 10 (install the motor before installing the tail feathers and pushrods. (Some steps in the instructions have already been done at the factory.)

When installing the rudder and elevator servos (page 8), we're told to use the long servos arms, and the photos show using the outer holes. Don't do it! This results in way (way!) too much control surface throw later, so you'll have to remove a lot of stuff to get back to the servos to fix it. You may even have to reposition the servos! Do yourself a favor now and use the outer holes on the *short* servo arms. And once you have the servos in place, go ahead right now and energize those two servos and check the control throws (see settings on page 18). Don't use your transmitter to reduce servo travel any more than absolutely necessary! Remember, when you reduce servo travel, you're also reducing servo resolution (not good).

By the way, if some small hardware items begin disappearing while you're working near the front end of the fuselage, check the magnets around the nose and you'll probably find what you're missing.

Also, this kit comes with a 0.9mm hex wrench (Allen wrench, L-wrench, whatever). Don't lose it! You don't find these at just any hardware store, and you'll need it to make pushrod length adjustments. I suggest putting a piece of tape half-way along the long arm to improve its visibility factor to help prevent it from wandering off.

The motor installation begins with step 1 at the end of page 9, and goes through step 3 on page 10. Step 4, had it been included, would remind us to install the prop adapter at this time. I used the one that came with the Electrifly motor, adding a drop of thread locker to each screw, and tightening them with a 2mm ball driver.

Now, about those 1mm wires to be installed on the dummy engine to look like pushrod tubes. First of all, know thee now that if you don't take the time to drill those 36 holes correctly, and get the pushrods properly aligned and parallel, the finished engine may wind up looking worse than it would have without them. Secondly, be sure the wires are pushed all the way up into the tops of the cylinders before you glue them in place. I thought mine were all the way up, but I later had to grind off the bottoms of some when they interfered with the motor.

In step 9 on page 11, the instructions suggest trimming the front of the cockpit hatch for cowl clearance. I found it more practical to lightly sand the interference spots along the rear edge of the cowl instead.

During the aileron servo installation there's a frustrating, but non-critical error in the instructions. On page 14, in steps 11 & 12, we're told to fasten the servo hatch covers in place with four screws each.

This is frustrating because step 4 of the next section on the very same page tells us to remove them again!

We have to use CA on the aileron pushrods. Be sure to use a micro-tip applicator (or dab it on with a pin or toothpick). You *don't* want CA running down the wire and gluing the pushrod to a control horn or servo arm.

Before assembling the aileron pushrods to the top wing, check the aileron movement. I had to trim away the Roundel material at the hinge line on top of the wing before the aileron would move upward properly.

Although they work fine when properly assembled, I still don't like these two-piece, non-adjustable aileron pushrods. They're not only non-adjustable, but the ones joining the upper and lower ailerons will have to be destroyed to remove the wings.

When setting the control surface throws, the book calls the rudder throw "up and down", and they have the high and low rates backwards, but you know what they meant. Just do it.

Now we come to checking and setting the CG. The last picture on page 19 shows 3/4 oz. of lead attached to the motor mount box, and the first paragraph on page 20 says we're likely to need 1/2 to 1 oz. of nose weight. Well, it's been my experience that you'll probably need at least twice what the instructions say you're "likely" to need, or what you "may" need.

So what did I do wrong? Or even better, "What did I do *right*?" Guys, my Camel was dead on the recommended CG without having to *shift* anything or *add* anything! (Boy am I good!)

So now let's land this airplane on some scales to check its tonnage. It's supposed to weigh 21 to 26 oz., and mine weighs 23.9 oz.), almost dead center in the recommended range. And unless my calculator's lying, this gives the little Camel a wing loading of only 8.82 oz./sq.ft.

My Camel, by the way, doesn't have its little clear plastic windscreen because... well... when it came time to install it, I couldn't find it. I lost it. Sorry.

FLYING THE SOPWITH CAMEL

Without a tail wheel for directional stability on the runway, we were expecting problems with ground looping. Although we had none this day, they may show up later. See, I set the model on the runway facing into a rather stiff wind, and when Tony nailed the throttle, the Camel took off without a roll-out. Seriously, I don't think it moved forward even half its length before it was off the ground in a steep climb. I yelled at Tony for it, and he said he didn't even touch the elevator! (Sure enough, it later required several clicks of down-trim for level flight.) The immediate and steep climb is no tragedy in this case because the Rimfire motor provides way more than enough kick for the Camel's feathery weight and glider-like wing loading.

The ample power showed up again during normal flight... the Electrifly Sopwith Camel is peppy! Mine is using the same propeller, motor, and ESC as the Electrifly Fokker that I reviewed in our Dec 08 issue, and they have a similar 36" span. The Camel, however, is 1.8 oz. lighter (even with a heavier battery), and it has 25.5 sq.in. more wing area, giving it a slightly lighter wing loading. It doesn't seem like much, but the difference in performance is obvious. Now, I'm not saying that the Camel flies *better* than the Fokker, I'm only saying that it's peppier... faster in level flight, and faster in climbs. We didn't fly them side by side, mind you, so this is only an impression based on memory, but we both felt the same way about it.

Within the normal constraints of a small, electric model, the Camel is very maneuverable! The suggested control surface throws seem spot-on, and when using high rates and a handful of throttle, the Camel is an aerobatic fool! Tony was flying pattern maneuvers with it! Yet when slowed to a walk and forced into a stall, it momentarily hovered in the wind, then began moving backwards in the wind, before it finally dropped its nose when the wings quit flying. Although it usually fell off to one side, it wasn't always the same side, so we're assuming that was because of the wind.

Okay, ample power and highly maneuverable, but how does it land? Well, it's forced-stall response earlier suggested its ease of landing, but there's a bonus I'd overlooked. The Electrifly Fokker has a triangulated landing gear with no shock absorbing capability. The Camel only *appears* that way. The axle screws fit into the axle tube, but they can slide in and out, so the landing gear looks scale but will still spread and rebound to share the shock absorbing duties with the tires on the wheels. In other words, the Camel will land nicely with fewer bounces on a hard runway than the Fokker (although both land well in the grass).

Although he hesitates to say so in just so many words, I get the impression from Tony that he likes the $100 Camel more than the $85 Fokker. Me, I'm not so sure. I like them both. And since no one asked me to pick one over the other, I won't!

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PRODUCT TEST REPORT

The Ultimate Flight Stand (yardstick included for size reference) and at right with the optional Heli Tray (don't ask).

Item Tested.... The Ultimate Flight Stand (PA800)
Purpose..... Portable folding stand for field and sometimes workshop use, to hold a model airplane and associated tools and/or support equipment.
Manufacturer & Distributor..... Precision Aero
1561 River Highlands Drive
Oconomowoc, WI 53066
www.precision-aero.com
(262)352-6670
Price..... $145.95 plus shipping
Applicability..... Model aircraft (and more)
Folded Dimensions..... 35.7x24.3x4.5"
Erected Dimensions..... 42.5x24.3x32"
Lower Shelf..... 23.1x18.1", 11" high
Top Shelf..... 24.25x12.6", 25.5" high
Total Shelf Surface Area..... Approx 714 sq.in
(Heli Tray adds 312 more)
Fuselage Cradle.. 22.5" long, 7" tall sides, with an adjustable width up to 14.5", and a base 36" high
Weight..... Approx. 15 lbs.
Instructions.. Comes pre-assembled, but an 8.5x11" sheet explains folding, unfolding, and finishing.
Materials Used.. Maple framework, Birch plywood shelves, steel and brass hardware, and rubber cradle pads (adjustable and replaceable).
Finish..... None (natural wood)
Hardware Included..... Everything required
Available Options... Wheel Kit (not shown) $25.95
Heli Tray (12.7x25", 4.25 lbs.) $25.95
Replacement Pads Kit (eight pieces) $9.95

CHEERS - Comes completely assembled and ready to use (or finish); mostly pre-sanded and ready for user's choice of finishes; folds and unfolds in seconds; sturdy construction for heavy models and long life; shelves and model cradle are at a good working height; very handy and useful at the field and sometimes even at home in the workshop.

JEERS - Requires extensive disassembly for proper finishing; some screws loosen over time.

Darnit! Here's another item that I never wanted or gave much thought until I saw one! This is probably

because we're so spoiled here at the Rocket City Radio Controllers flying site in Huntsville, AL. We have plenty of assembly tables, in the shade, and with plenty of 120 volt outlets nearby. Well, normally, that is. But whenever the club hosts a big event, the place fills rapidly, and only the distinguished flyers, VIP's, and early arrivals get the shade. Nobodies and those who habitually arrive late find themselves pitting out on the open grass areas. There they can pitch a tent or canopy for shade, but unless they brought their own table (or one of these deluxe flight stands), they're left to crawl around on their hands and knees to assemble, disassemble, and work on your model(s). I know, because that's where I always wind up! Now, though, at least I won't be crawling around on my hands and knees. I have a cool Ultimate Flight Stand!

How much weight will it support? I don't know, but it seemed so sturdy, I actually stood on the lower shelf, so I know it will support at least 23.... uh... over 200 lbs. And I'm guessing that the heights of the shelves and fuselage cradles were developed through a lot of use and experimentation, because they're all at the perfect height for me (6' tall). Even the top shelf seems the ideal size, because if made any larger you'd have to lean way over it to reach the model. No, too much of this flight stand is "just right" to be a simple coincidence. The shelves are boxed-in with 3/4" tall sides to prevent things from rolling off, too.

In their standard positions, the cradles adjust from 4.5 to 14.5" wide, but the outer L-brackets can be reversed for fuselage widths up to 4" wide. For little electric models I use a smaller model stand (a Goldberg "Mini-Hold 'Em") on the heli-tray, and I'm developing some custom trays (aka shelves).

The Ultimate Flight Stand comes fully assembled right from the box, and you don't really have to apply a finish if you don't want to (I still haven't painted mine yet!). I intend to, though, to make it fuel resistant as well as making it more attractive.

The stand comes with eight 5" long cushioning pads that consist of a firm rubber tube attached to an aluminum channel. The channel fits snugly onto the 3/8" plywood cradles, so they can be installed, removed, and adjusted at will without tools.

For transporting, the Ultimate Flight Stand folds neatly into a "package" measuring about 36x24x4.5". I lay mine flat on the floor of the cargo area, and place a model or two on top, using its "nooks and crannies" to hold the wheels in place so the model stays put while driving. Double duty!

Now folks, bear with me here, because this may sound a little weird, but I've also been using the Ultimate Flight Stand for... well... non-modeling uses. There, I've admitted it. I recently set it up right beside a motorcycle while I was adjusting the valves. The stand held tools and parts at an easy reach. I've used it twice to hold tools, paint cans, and hardware while I was working on backyard projects. And when Mina saw the latter use, she said she wants to use it to hold "stuff" during backyard cookouts (but I have to "paint it pretty" first!). The way I see it, sure, it's a great model airplane flight stand, but it's also a portable work bench, a temporary work site shelf unit, and more. I'm already dreaming up other uses for it, and I'm planning some add-ons and custom purpose top trays to expand its usefulness even further. The challenge is to have useful add-ons for some purposes, but without impeding on other uses. For example, can I add some under-the-shelf brackets for a field-use battery charger that won't get in the way of the potato salad, buns, mustard, ketchup, onions, relish, chips...

Well great! Now I'm hungry. But I don't know what else to tell you anyway. The Ultimate Flight Stand works great for all sorts of odd jobs. It's strong and sturdy, it's easy to set up and take down, and it's just mighty handy to have around. One of these days I'm going to take it apart and paint it, too. No, I mean it. *-Gordon Banks*

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SMILEY FACE HUNTERS

There's no more contest, of course, but we hid 10 Smiley Faces in this issue anyway for those who want them. See page 4.

Bird on a Wire

by Terry Dunn

Do you ever get the feeling that the world is spinning just a little bit off-axis? I'm talking about that sensation where white is grey, kids love to watch "Newhart" reruns, and even your favorite pizza tastes funny. That's where I'm at right now. The first symptom showed up last week when it snowed in Houston (that's Houston, TX, not Houston, ND). Next came Gordon's phone call informing me that this would be the last issue of *"R/C REPORT"*.

Speaking as a *reader* of RCR, I'm truly saddened to be losing this untarnished source of information and entertainment that has no equal. As a *writer*, I am grateful to have played at least a short role in the RCR legacy. I would like to send a huge thanks to Gordon, who granted me the creative freedom to mold my three articles and five columns into genuine reflections of my personality. Who else would let me joke about "inscentination" and bent shafts in print? An equally huge thanks goes to you readers who have taken the time to write and make me feel welcome and appreciated within these hallowed pages. Thank you, thank you all!

At the close of my previous column, I indicated that I would pick up this month by walking you through the steps that I use to select a power system for a specific airplane. As it turned out, I had the opportunity to design the power systems for *two* airplanes, each requiring a slightly different approach, so I'll touch on both.

Before getting to the technical stuff, allow me to give you a little background on the first model, a simple, .40-size trainer. A few months ago a friend, Lee Ray, invited me to try aero-towing with his Multiplex Easy Glider and e-powered Hobbico FlightStar tow plane. Aero-towing is where a powered airplane pulls a glider to altitude with a long line. Other than a ride in a full-scale glider, I also had a little experience as the tug pilot aero-towing smaller models, and Lee had previously flown his Easy Glider behind another pilot's tow plane. One thing that our limited collective experience had taught us both is that coordination between the two pilots is essential.

We had an absolute blast that afternoon. Sure, we had a few communication breakdowns that caused us to 'crack the whip' on the glider (you water skiers know what I'm talking about), but the tough Easy Glider shook off the resulting violent maneuvers. Lee's FlightStar has enough power that he could have schlepped the glider off the runway at a 45° departure angle for a quick ascent to the release point. However, we took a much more subtle approach by gradually

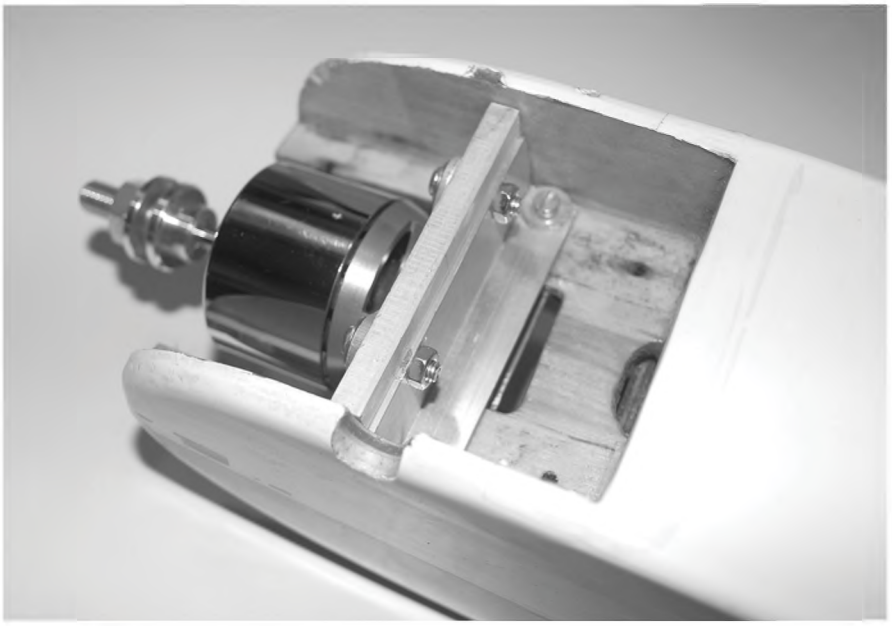

Photo 1: The Grayson Hobby GH3520-12 motor gives a little over 600 Watts for this 6 lb. airplane, perfect for my 100 Watts/lb. target. The aluminum X-mount included with the motor required some reshaping to fit the motor cleanly. Some aluminum angle stock and 1/4" lite-ply was all it took to mount an outrunner brushless motor to the existing beam mount of the Minicraft Simpli-Fly 40.

climbing during three or four large circuits of the field while honing our formation flying skills.

There was limited thermal activity that day, but I got in one glider flight that lasted about 30--mins. But more often than not, I would fly around for a minute or two after release and then put the glider in an energy-killing spin so we could quickly do another tow! When I left the field that day, I was determined to build an aero-tow rig of my own. And that brings us back to my .40-sized trainer, a Minicraft Simpli-Fly 40.

When I told my buddy, Bill Schwander, that I needed an ARF trainer to serve as a glider tug, he pulled out a Simpli-Fly out of his goodie bag for me. It's a hand-me-down of unknown origin and age that has the tell-tale aroma of a nitro-burning past. I had to do a little research just to figure out what plane it is. Despite the lack of pedigree, it was in relatively good shape and fit the profile I was looking for. To complete my aero-towing package, I ordered a new Easy Glider as well.

Actually having the airplane in-hand makes the task of designing the power system a little bit simpler. You don't have to guess the airframe weight or wonder if there are any obstructions to mounting the motor or battery. But to be honest, I had already figured out the basic power system I would use before Bill even gave me the Simpli-Fly. It was easy to see by flipping though a few catalogs that most .40-size trainers weigh around 5-6 lbs. with nitro power. So, I took the worst case scenario and assumed my plane would end up at 6 lbs. Recalling from last month's column that I generally like to aim for a 100 Watts/lb. power loading, I planned to use a 600 Watt motor for my 6 lb. plane. Just from experience, I also know that most .40-size trainers will allow clearance for a 10" prop, so I factored that in as well.

At this point I found myself shopping for a motor that could produce at least 600 Watts of power with a 10x12 prop. No problem. I'm sure I could find numerous valid candidates in several different catalogs. However, my favorite store is my own workshop (for one thing it's open at all hours). I like to keep a sundry collection of power system and radio components on hand so that I'm not hindered by an equipment shortage when an idea for something new hits me. You've got to strike while the iron is hot! So whenever I find a good sale on e-flight stuff, my motto is "Grab all you can before the hoarders show up!"

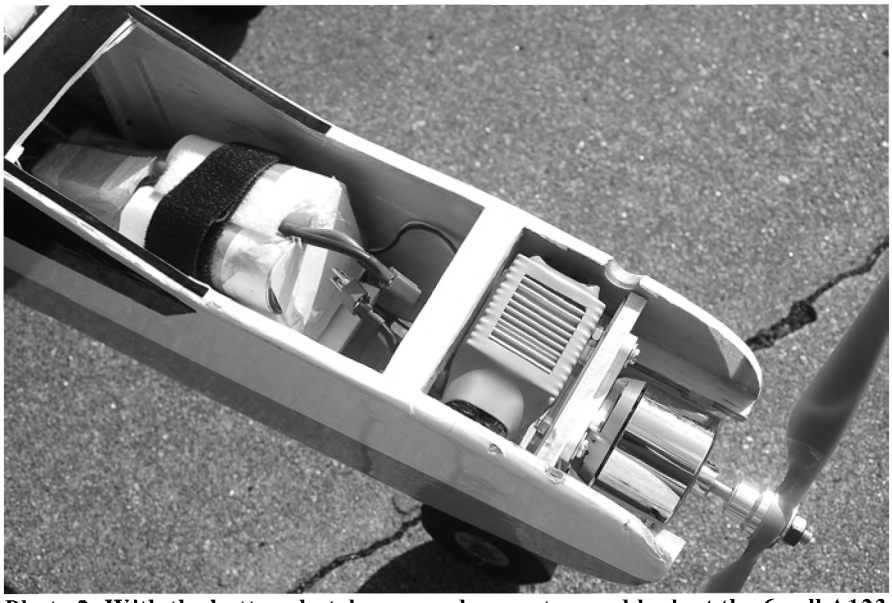

Photo 2: With the battery hatch removed, we get a good look at the 6-cell A123 battery that occupies the space once taken by a glow fuel tank. Also notice the unplanned yet ideal mounting spot for the ESC just behind the motor. While not elegant, this location will provide a nice source of cooling air.

Photo 3: The completed, electrified Simpli-Fly 40 is ready for flight testing, and then some aero-towing adventures!

A quick scan of my stash produced the Welgard GH3520-12 outrunner brushless motor seen in **Photo 1**, and a 50 Amp ESC. The motor's specs say it's rated for 625 Watts. Bingo! The vague references to prop size also seemed in line with my needs. I bought this and a few other motors from Grayson Hobby during a sale last year. I'd previously used and liked some of the smaller motors from Grayson, so I felt comfortable buying the larger units sight-unseen. The motor itself appears to be of good quality, but the included firewall X-mount looks as if it were machined with a dull hatchet. After a few minutes of tweaking with a grinding bit in my Dremel and a countersink bit, the mount was fine.

Once I got the Simpli-Fly home, the most pressing task was mounting the motor. There's a lot of room for creativity here, but I try to be as non-invasive as I can and use existing structure whenever feasible. In this case I used the lite-ply beam mount already in the nose. I only had to add a new vertical firewall spaced appropriately for the electric motor. It took me about an hour to sculpt some aluminum angle stock and 1/4" lite-ply into a simple, yet, rugged custom mount. As a bonus, there just happened to be room behind the new firewall to cleanly mount the ESC in the breeze (see **Photo 1**).

The final task in converting this plane to e-power is to fabricate a mount for the battery. I'm using a 6-cell A123 Lithium- nanophosphate battery. In terms of voltage and weight, the A123 is roughly equivalent to a 5-cell 3700 mah LiPo battery. The trade-off is that the A123 cells have relatively low capacity (2300 mah) but are more tolerant to abuse than most LiPo batteries. To get the proper CG for this model, I would need to mount the battery right where the glow fuel tank used to be. It just so happens that the fuselage formers that used to cradle the glow tank also snuggle the 6-cell A123 battery quite well. All I added was a narrow lite plywood tray between the formers. A little Velcro on the tray and a Velcro strap hold the battery in place (see **Photo 2**).

For easy access to the battery I cut a hatch into the fuselage sheeting. Sure, it's a pain to make the hatch. But at the field, the hatch is much safer and more convenient than having to remove the wing to get to the battery. The ESC I used does not have a built-in BEC, so I added a 4-cell 720 mah receiver battery to power the radio. With everything in place, the Simpli-Fly came out to 91.2 oz., about 5 oz. shy of my 6 lb. forecast. Not bad considering that I didn't even know what airplane I was going to use when I made that prediction!

Once I had everything installed, I did a little bit of testing with my Wattmeter to determine an appropriate prop. I found that with a 10x7 APC-E prop and the 6-cell A123 battery, the GH3520-12 produces 616 Watts at 35 Amps of current, so that sounds like a good starting point. But numbers don't

tell the whole story, so the final prop decision can only be made after flying the airplane. I had intended to devote *this* column to the power system design and installation, and then I'd focus on flight testing, power system tweaking, and aero-towing in the April issue. Since there won't *be* an April issue now, feel free to email me if you'd like any information on the follow-up portions of this project. By the time this issue hits your mailbox, I should have the flight testing completed (see **Photo 3**).

The second airplane we'll look at is a 66" scale model of the Cessna UC-78 Bobcat, or "Bamboo Bomber" (see **Photos 4 & 5**). This rarely-modeled warbird is a pet project of Bill's, and like most of his airplanes, it will no doubt turn out gorgeous. This particular model required a slightly different approach to the power system design because it's scratch-built, and it's a twin. When we build from scratch, we're presented with challenges and benefits when determining the power system. The biggest challenge is that you may not have a solid prediction of the final weight. Since weight is the key ingredient to designing the power system, you must either guess-

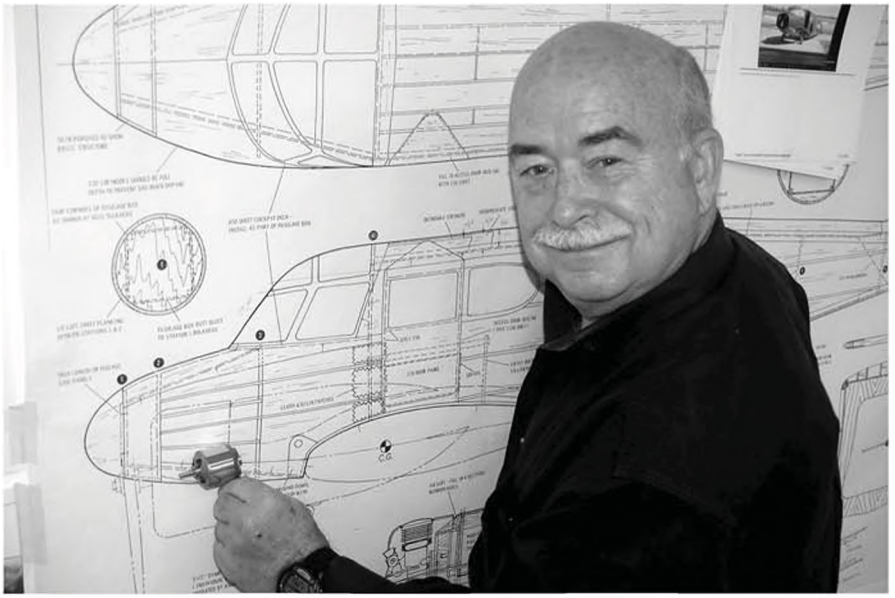

Photo 4: Bill Schwander holds a Grayson Hobby GH2820-06 motor over the plans for his upcoming Cessna UC-78 Bobcat. Two of these motors should have no trouble hauling the "Bamboo Bomber" around with good authority.

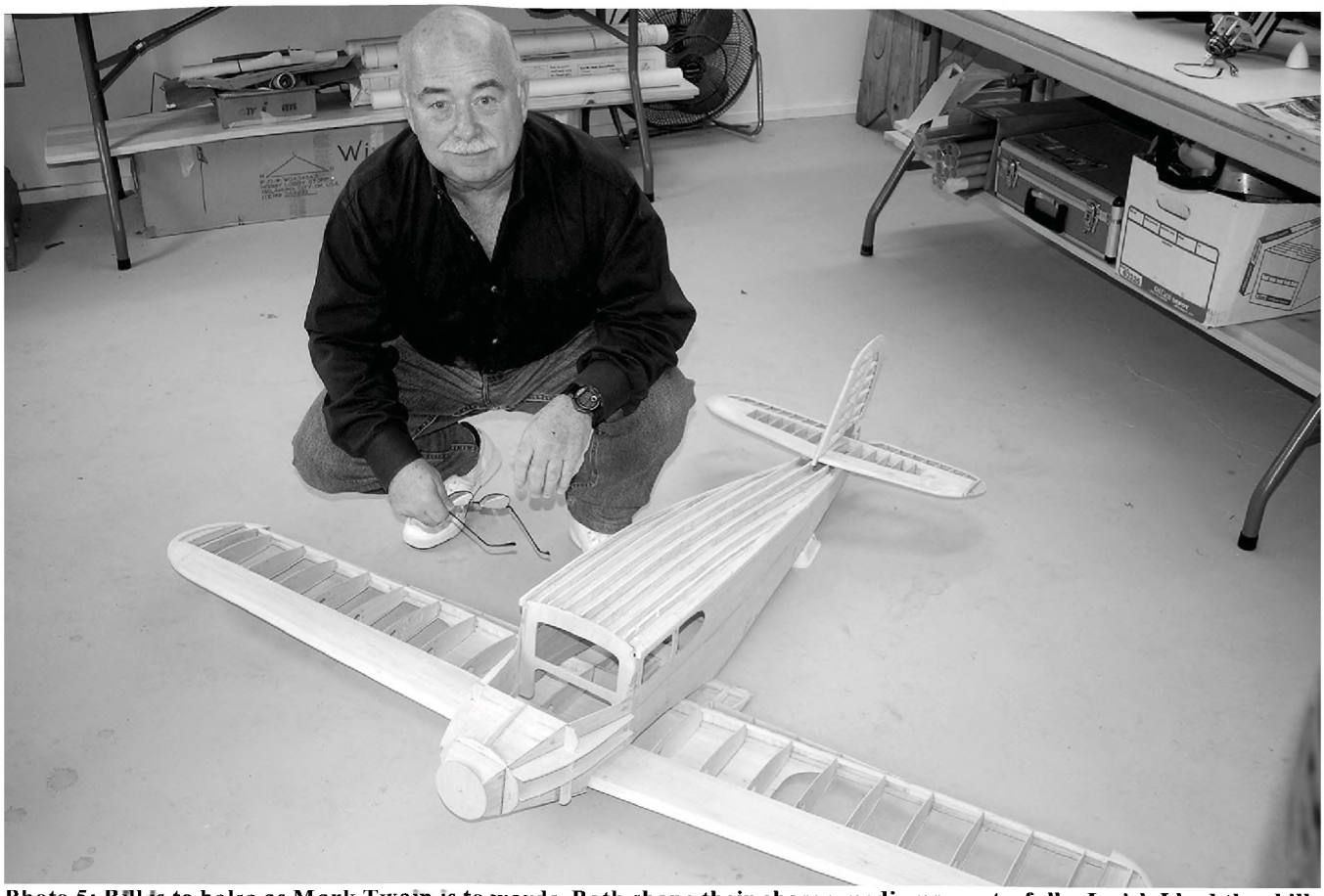

Photo 5: Bill is to balsa as Mark Twain is to words. Both shape their chosen mediums masterfully. I wish I had the skills of either. The weight of the partially completed Bobcat suggests that it will be lighter than we predicted. Hooray!

timate the final weight based on experience, or defer selecting the power system until the airplane is at least partially built. Once some of the construction is complete, you can often extrapolate the final weight with some degree of confidence. In the case of this Bamboo Bomber, Bill and I stared at the plans for a few minutes and decided that this would likely be an 8 lb. airplane. The benefit of scratch-building is that you can tailor the airframe to your exact preferences without having to dismantle someone else's vision of how it should be built.

With an 8 lb. plane we want 800 Watts of power to fly it. But wait... there are *two* motors on this airplane! Call the folks at MENSA and have them sharpen their pencils, we've got some serious calculating to do here. Let's see... (imagine the sound of furious head scratching and frantic scribbling on a huge chalkboard) if we need 800 Watts from two motors, we'll take the width of the runway to the 4th power, then we divide that by the volume of air in the tires, then of course we must add the Indonesian market price of gold while factoring the inflation adjustment. Okay, I realize I'm probably getting over your head at this point, so I'll save you some embarrassment and also protect a few of my precious trade secrets, I'll just give you the answer. If you want to produce a total of 800 Watts from two motors, each motor must produce 400 Watts. Don't try to understand these incredibly complex calculations; just take my word for it.

So here we are in the shopping mode again. We're now looking

for a pair of 400 Watt motors that will spin props about 11" in diameter (for safe ground clearance). Since I already had Grayson Hobby on my brain from working on the Simpli-Fly, I checked their website to see if they had any motors for this project. Sure enough, the Welgard GH2820-06 motor looked like a good candidate, and being on sale didn't hurt any, either. I took another leap of faith and ordered two of them. I don't mean to sound like a commercial for Grayson Hobby, they just happen to be the vendor I used for both of these projects. I still haven't formed an opinion on the larger Welgard motors, simply because I haven't flown with them. Once the Simpli-Fly and Bobcat have some air time, I can comment on these motors intelligently. Bill and I haven't even hooked up the GH2820-06 motors yet, but my bench testing with the GH3520-12 has revealed nothing to be concerned about. For what it's worth, the X-mounts included with the GH2820-06 motors are nicely machined, unlike my earlier example from the GH3520-12.

I was a bit slow ordering the motors for Bill's Cessna, so by the time they arrived, he had already completed quite a bit of the framing. Looking at the existing structure, it's likely that the Bobcat will come in under our 8 lb. estimation. That's a good thing. We can either reduce the power output of the motors with smaller props, or just enjoy the surplus power. Bill can make that decision down the road. One decision that needs to be made soon, however, is how the two power systems will be configured, because this will determine how some of the structure is built. It's a given that the motors and ESC's will be mounted in the engine nacelles. The question is whether to also mount the batteries in the nacelles, or move them to the fuselage with long leads to the ESC's. And if both batteries are in the fuselage, would it be preferable to use one large battery instead? Bill is deferring these decisions until more of the airframe is completed. All are completely valid configurations, but the simplest option is to have a battery mounted in each nacelle. However if nose weight is needed, it would be better to have batteries in the nose instead of useless lead. The question of using two small batteries or one larger one will likely be answered based on economics.

Well, I guess that's it. Even though I won't be gracing the intelligence rack in your bathroom any more, I'll still be around, so feel free to email me. Please note that my email address has recently changed. I'm happy to answer your e-flight questions, learn from your personal expertise, or just swap stories. Once again, thanks for allowing me to share my thoughts with you these past few months. It has been a tremendously rewarding experience. Take care.

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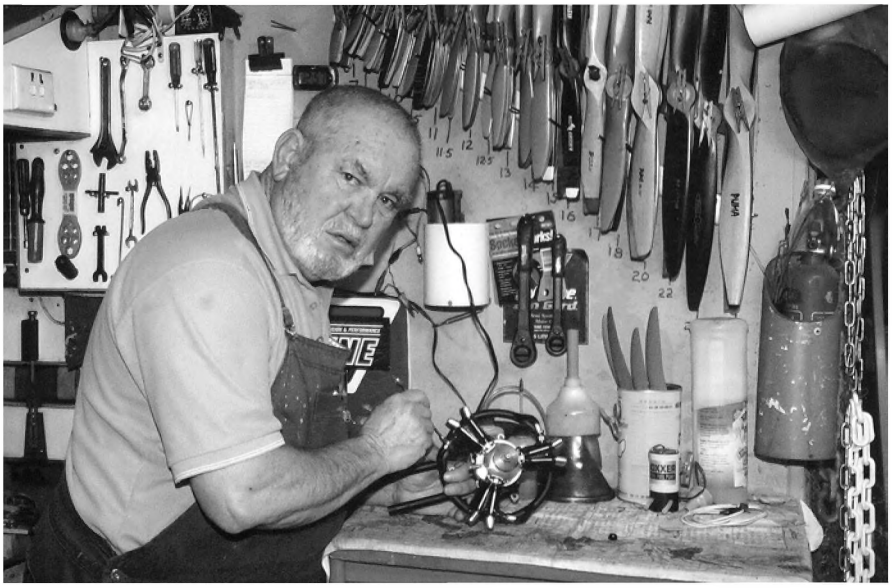
The Oily Hand

by Brian Winch

DIAMONDS ARE FOREVER

All joy and balloons here for a moment. At the time of writing this, in Dec 2008, my dear wife (Shirley) and I are thinking of all the years we've shared since Dec 19, 1958, the day we were married. We've been together for around 57 years, as we went out together and were engaged during the seven years before that big day. It's a shame that so many younger people are amazed at the duration of our time together (and we intend to spend a lot more of the same!), and that they have to ask how we survived(?) so long. The simple answer and one that works for many people like us, is that we care about and respect each other. Shirley would never question any purchase I made for my modeling hobby, and I would never question any purchase she made of clothing, jewelry etc. However, there are two factors to consider that sews it all up nicely. Neither of us would ever even *consider* a purchase made to the detriment of general living expenses, and (now comes the big one, you blokes) I often bring her many little gifts for no apparent reason. Whenever I go on my distant field trips (modeling, or in earlier days hunting) I always



came home with a few passengers in the form of Teddy Bears of all types and sizes, both new and old collectibles. She is an avid collector of bears, you see, and has hundreds of them on display. Plus, she loves every one of them. My only problem is when I'm getting dressed in the bedroom, I can feel hundreds of beady little eyes looking over the Oily Hand's nakedness (the perverts!).

Another factor that's part of our overall scene is the giving of gifts for special occasions. Never give anything that's "needed" unless it was expressly requested. For example, you may need new underwear because your old "comfortable" ones have holes or oil stains on the front (from having oily hands when you just gotta go). New underwear is not a suitable present, they're a necessity. That's like giving her a new floor broom because the old one is getting worn. Man, I gotta tell ya... give her a broom as a gift and you can kiss your chances of buying (or receiving) new modeling toys good-bye!

This outlook stems from my very young days and some mean family members who always made a big thing about giving me one or two handkerchiefs for birthdays

and Christmas, and my mother used to lean heavily on me to make sure I expressed a great deal of gratitude, and tell the big lie that the lousy handkerchief was "just what I wanted and had hoped for." Yeah, right! I would have been happier with a comic book or some marbles in the same price range as the snot rags. Still, it's an ill wind that doesn't blow *some* good. As I progressed to little diesel engines for my models, I had loads of hankies in my drawer that were great for wiping off young Oily Hands.

Anyway, I bought Shirley a really nice multi-diamond ring (next to bears she loves finger jewelry) for our anniversary, and she turned me loose in Dick Smiths (a computer gear, electronics, tools, and general "men's stuff" store) with the instruction, "If you like it, get it!" Well, let me say it easy, we now have enough Dick Smith carry bags to last us at least until June or July.

So how does this tie into R/C modeling? Simply by helping some readers learn to smooth out a few bumps on the road to getting gifts *we* like. What is the value of a diamond? According to one of the DeBeers family, the greatest value is in industry. Cosmetic diamonds (those worn as jewelry) are worth only what a buyer is willing to pay. For the ring I purchased this time, there was a known value for the gold content, a known cost for the ring's manufacturing process and diamond cutting work, but the actual value of the diamond came down to a basic law of merchandising... offer and acceptance. The jeweler offered the goods to me for a certain price, and I accepted. And then he bargained for the future by adding, "Since you've been a very good customer here for many years and have never asked for a discount (that's a personal policy of mine), I'm going to reduce the price by 25%". (Beautiful! That means a new O.S. FS-110 Alpha 4C engine for me, and I still get the ring!)

PUTTING THEM TO WORK

While the diamonds glitter on our ladies' fingers, for me they're much more useful when we put them to work in the shop. I think diamonds still hold first place for being the hardest known substance on earth. If not then they're at least a close second. Diamonds will cut any other material with very little detriment to themselves, but nothing else will cut a diamond. Faceting, the shaping of rough diamonds, is done with shock chisels, wooden mallets, and other diamonds. Line up the chisel to shape a face, tap it and a slice is chipped off (very simply put). However, the same diamond being cut could be used to sharpen the chisel! In days past the problems encountered in using diamonds and

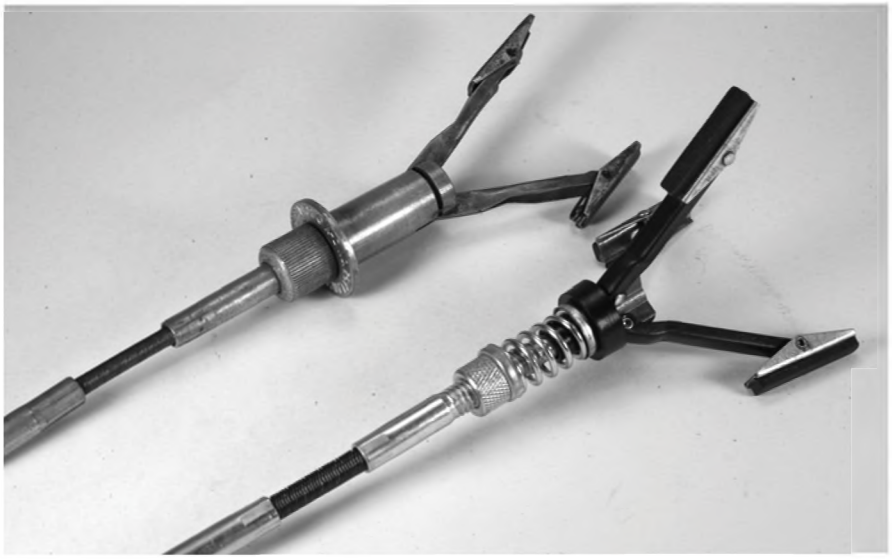


Photo 1: Brake cylinder hones are ideal for honing model engine cylinders.

Photo 2: Diamond paste comes in three grades. I find the course or medium most suitable for our type of work. It's inexpensive and available from tool stores.

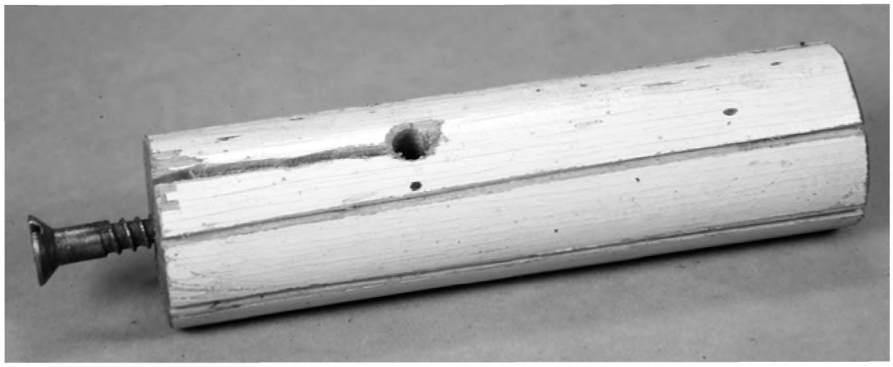


Photo 3: Here's a simple wooden lap that works well. Drill a hole through the end of the slit to prevent it from breaking as you wind the screw in.

diamond dust was to find a suitable carrier material and bonding agent. Basically, this means a substance to hold the diamond chips and adhere them to a tool as required. That's all in the past now that super tough bonding agents are available, and the process of impregnating diamond dust and chips into metal is now common.

For a long time I've had a very thin diamond saw that will cut the hardest of stone, and it will slice through metal like a hot knife through butter. At the time of purchase it was almost a major outlay to obtain that blade. These days they're almost in the 'dime a dozen' range, and you can pick up diamond saw blades for hacksaw frames, complete saws, and even circular saw blades in almost any size required. I recently purchased some 1" diameter diamond-impregnated circular blades for use in my Dremel tool, and they will cut a lot of materials quite well, with the best being the GRP materials like carbon fiber and the like. For many years I've had a 'diamond on a stick', a rough diamond chip gripped in one end of a 3/8" steel rod, used to dress the wheels of my toolpost grinder. The diamond stick is gripped in the chuck so that it points towards the toolpost, the spinning wheel, or a burr on the toolpost grinder is wound in while it's running, and the diamond tip dresses the wheel dead square to the centerline of the lathe.

Obviously the great reduction in cost and use has come about by the *manufacturing* of diamonds (man-made diamonds), and this has made possible a great leap forward in this field of tooling and other industrial applications. Every modeler should have access to diamond cutting and surfacing technology for the many difficult jobs that crop up from time to time in the model shop that require a cutter much tougher than the material to be cut or machined.

When I service a worn model engine for a customer and determine that it needs a new piston ring, I hone the cylinder to re-surface it and remove any hard glazing. This is quite easy if the engine has a steel liner, and I use a

car brake cylinder hone for the job (see **Photo 1**). However, if the liner is hard chrome plated or one of the modern super hard and slick surface treatments, my honing stones groan and glaze over rapidly. For these materials I have to use diamond paste which is available in various grades, as required for the job (see **Photo 2**). I put a dab of medium paste (for an average job) on each pad of the hone, squeeze the pads down (they're spring loaded), insert them into the liner, and carry out a normal honing job. I'm not re-sizing the liner in this instance, just de-glazing and scratching the surface in a course figure 8 pattern. For the occasional job you can obtain quite a good result by using a simple form of lapping. You need a short length of dowel(a wooden broom in many cases) that's a reasonably neat fit in the liner. Cut four or five very shallow slits with a Zona type saw the length of the liner plus about 50% vertically along the dowel (see **Photo 3**). Then cut a narrow slit down the center of the dowel and start in a tapered wood screw. As you wind the screw in, the dowel will spread a little to maintain contact with the liner wall. Dab a small blob of diamond paste on each slit and spread it along with a blade or something similar. Wind the dowel into the liner and turn it to and fro as you push it back and forth to "scratch in" the figure 8 pattern on the cylinder wall. It doesn't take much time, but make sure you have a good criss-cross pattern over the entire inner surface. Believe me, you won't destroy the liner bore this way as it would take hours and hours to remove enough metal to cause a problem. Then clean the liner with a solvent, wipe it dry, and then wash it well with hot water and kitchen detergent. When you fit the new ring you will feel the good contact, and the compression will return quite rapidly after you run the engine for a while. You can use the same method for a steel liner, but you need only fine lapping paste (valve lapping paste) for that.

Before we leave diamonds behind there's this: a young friend who's just finished his apprenticeship with Mercedes Benz was telling me that there's a special diamond chip embedded washer used on the camshafts of some Mercedes engines. The washer is fitted between the timing chain sprocket and the locking nuts. The diamond chips grip the face surfaces of the camshaft and nut as solidly as a welded joint, but unlike a welded joint, when maintenance is required the pieces come apart easily. How many carats would you like in *your* Mercedes, sir?

Just for your interest, electroplating (chrome, nickel,

etc.) was invented by Werner von Siemens, born in Prussia in 1816, while he was in prison for acting as a second (a personal assistant) in an illegal duel. He later improved and developed the then new electric telegraph, and installed telegraph lines throughout Germany. So let's give a highly polished salute to his memory.

STOP THE PISTON,
I WANT TO GET OFF!

I've received some very nice email from readers concerned about some aspects of the article I wrote discussing piston-stop tools. Their concerns are about the valves and the angle of the plug hole in model 4C engines. To the extent of my knowledge, all OHV (Over Head Valve) model engines have a slanted entry for the glow plug, and the concern is that, due to the angular contact of the piston stop tool, the tool bit might bend or the crown of the piston might be damaged. Well, this is a very good thought on behalf of those who are worried about it, and is certainly worthy of consideration. However, let me assure you, the crown of a piston is very tough, like... *extremely* tough. In the 4C engine of concern, at 10,000RPM the piston is subjected to 5,000 intense explosions on its very hot surface every minute, and this can continue for as long as you supply fuel to the engine. For another consideration of how tough they are, every so often I have a repair or warranty job on the bench where an engine has dropped a valve. Valves in model engines are a very tough (hard) grade of stainless steel or high heat tolerant alloy steel, and they would take a very hefty whack with a decent size hammer to deform them to any great degree. Most of the time when a valve drops it's due to a broken valve collet (the little clip that holds the spring below the collet cup on the

valve stem), or the valve stem breaks where the collet is fitted in a groove. This always happens when the engine is running, and mostly at full song, so the propeller continues until the kinetic energy and momentum is dissipated, or the engine comes to a very abrupt stop when the valve stops the piston before it reaches top dead center. Use your imagination to develop a picture in your mind of an engine running at 10,000 RPM when a hard steel valve is suddenly dropped into the area above the piston just as the piston is traveling upward at very high speed. Generally the valve stem breaks or bends, the other valve is damaged, the empty valve seat will look like it's been hit several times with an ax, and the combustion chamber of the head has similar ax scars. The crown of the piston, however, may have a burr or two raised on its surface. If the valve turned as it dropped, it might drive the stem through the piston, but this is extremely rare. In the majority of cases, in fact, the piston is reusable after a clean-up with a file, Dremel, or a mild cleanup in a lathe. Pistons be tuff stuff, mate! I'd say you'd stand more chance of bending the stop tool than damaging the piston.

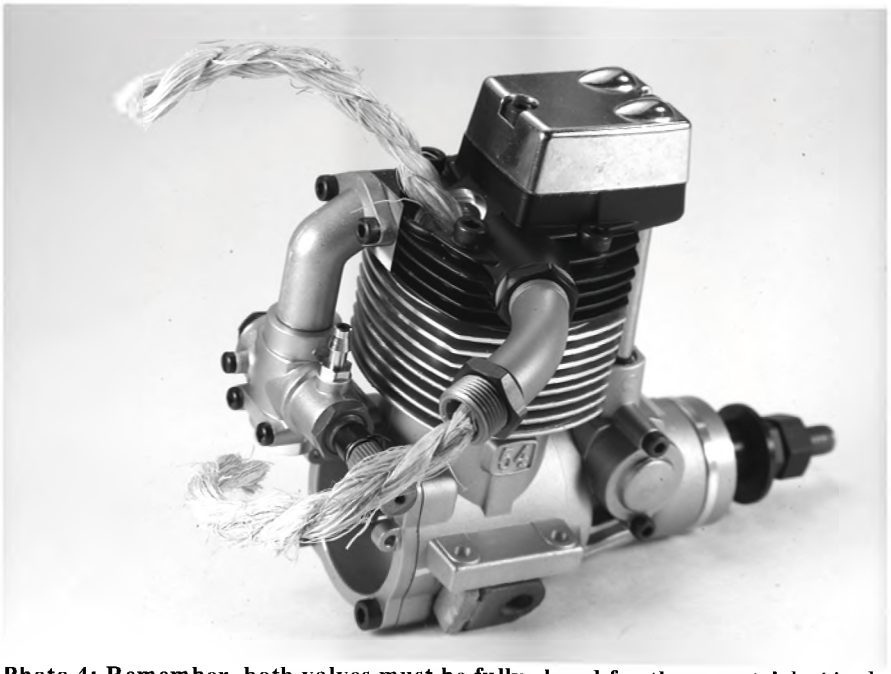


Photo 4: Remember, both valves must be fully closed for the rope trick. (And no, the rope doesn't come through the exhaust. Just a bit of fun here.)

Photo 5: This is how the rockers appear when both valves are fully closed.

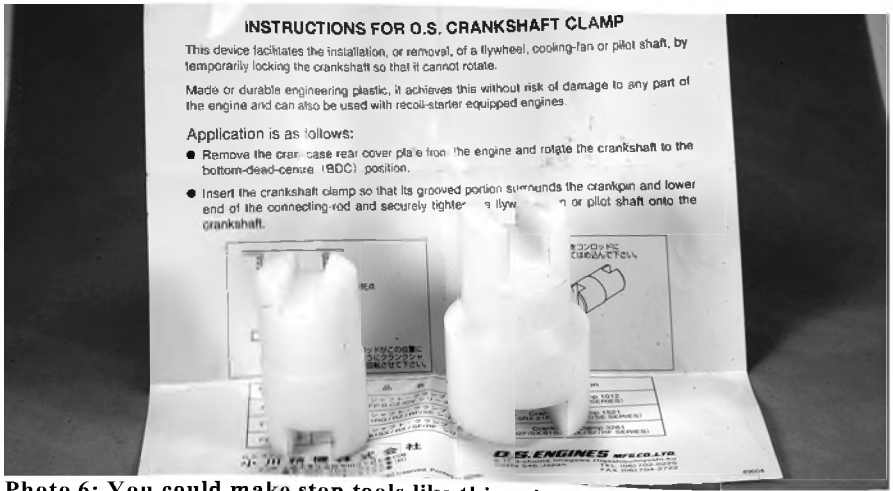


Photo 6: You could make stop tools like this using a wooden dowel if you have a regular use for them.

Having said that, I have had the need many times to use the stop tool in 4C engines, and the tool I use is the one I showed you made of reasonable tough aluminum alloy, and it's still good as new. If you round off the end of the stop tool to remove any sharp edges, I doubt you will even mark a piston. This statement, obviously, does not pertain to any modeler who's in the "heavy in the hand but light in the head" category, as their determination to destroy things will eventually break whatever they touch. A while back a modeler sent me a brand new Saito 300 (50cc) twin that had no threaded section on the crankshaft! He had broken it off when he fitted the very first prop on it, while using a 24" adjustable wrench to tighten the nut against a carbon fiber prop!

Okay then, the next concern is the valves. Any chance they'll contact the stop tool as the engine shaft is turned to remove the stuck prop (or whatever)? Wouldn't it be safer to use the rope trick (see **Photo 4**) mentioned by the character at the pointy end of this magazine? Yes, there is a *very* slim chance, if the piston stop tool is overly long. The valves should be on each side of the tool when you consider the plug position, but this would be a consideration only if you use the wrong engine stroke for the job. The damage to valves could be a concern even if you used the rope trick if they had to press down on a foreign object (the rope) as the stems are prone to flexing and the smallest amount of bend (we're talking microns here, thousandths of a millimeter) would be enough to upset the valve seal against the valve seat in the head. The correct method, and the method you have to use if you use a stop tool, the rope trick, or the oil fill method, is to have the engine

coming up on the firing stroke (combustion stroke) when both valves are closed. To check this, simply remove the rocker cover and observe the position of the rockers, which must be inline with each other and not touching the valve stem (see **Photo 5**).

Another stop tool I forgot to mention is the type that prevents the engine from rotating by slipping onto the connecting rod. Basically, a dowel with a reasonably neat fit into the crankcase has a slot that fits over the connecting rod. This too works well, and is quite simple to use. O.S. produces a couple of these in nylon that will suit a wide range of engines (see **Photo 6**).

RECYCLING SPECIALTY ENGINES

What do you do with a perfectly good ducted fan engine when you no longer want to use it in ducted fan models? (See **Photo 7**.) Bob Geisman of Hunter, NY, wrote to say that he'd switched to electric powered ducted fan models (lured to the dark side, eh?), and he was wondering if his ducted fan engines could be used in some other aspect of R/C, such as sport flying with an applicable propeller. Even though he's been attracted to the dark side, at least he hasn't joined the "trash gang", that ever increasing band of miscreants (with too much money on their hands) who simply trash good equipment they no longer want or need. Anyway, as to the ducted fan engines, to many modelers they come into a hazy area. By saying hazy, I liken it to that other hazy area of "hopping up" an engine. I have the occasional modeler ask me if I hop up engines. When I ask what they mean by that, the usual answer is, *"Oh, you know, making them go faster."* This doesn't take any black magic, or even doing things beyond the imagination of those not in the "inner circle" of engine modifications. The performance of an engine can certainly be changed to accent one aspect of performance, but it often comes at the cost of other performance attributes. A general overall high performance engine from a reputable manufacturer is sold to you at its peak, all round performance. It will start easily, idle reliably, transition smoothly, run at high RPM to produce good torque or power output, and should last quite a while. Generally speaking, to "hop up" the engine you could fit a carburetor with a larger venturi, change the exhaust port timing, or raise the compression ratio. Any or all of these will change several aspects of performance. The peak RPM might increase, but one or more other performance aspects, such as the starting, idling, transition, or longevity might change, and the change will rarely, if ever, be an improvement. Is there another method of obtaining higher RPM without altering the parts of the engine? There sure is, and it's very simple... reduce the load on the engine. What do you think Saito and O.S. did to their little .30 size 4C engines to get them to run at 22,000 RPM for use in R/C cars? They took off the propeller and fitted a flywheel. And that's about it other than a modification to the carb to suit the requirements of using them in cars.

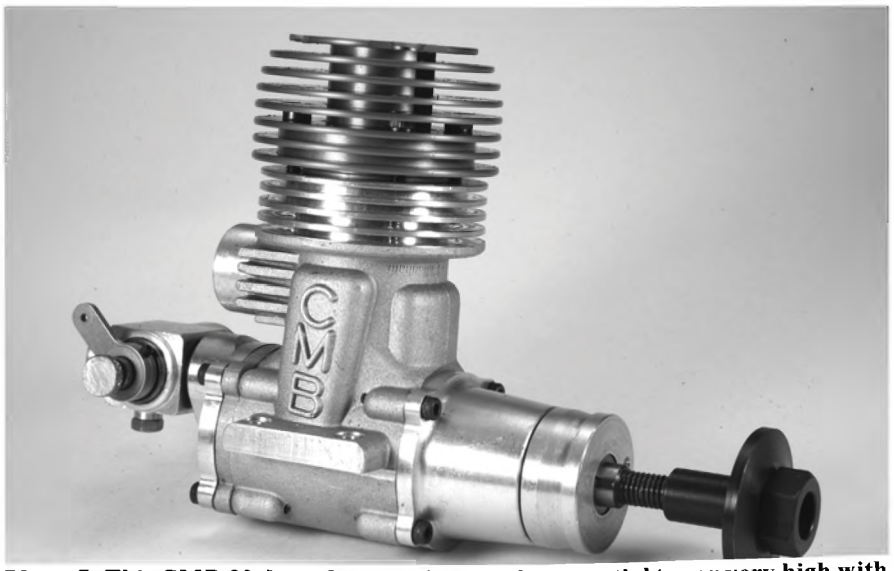


Photo 7: This CMB 80 ducted fan engine has the potential to rev very high with a fan or flywheel, but it still runs very nicely with applicable size normal props, which is what I used when I tested it for a review.

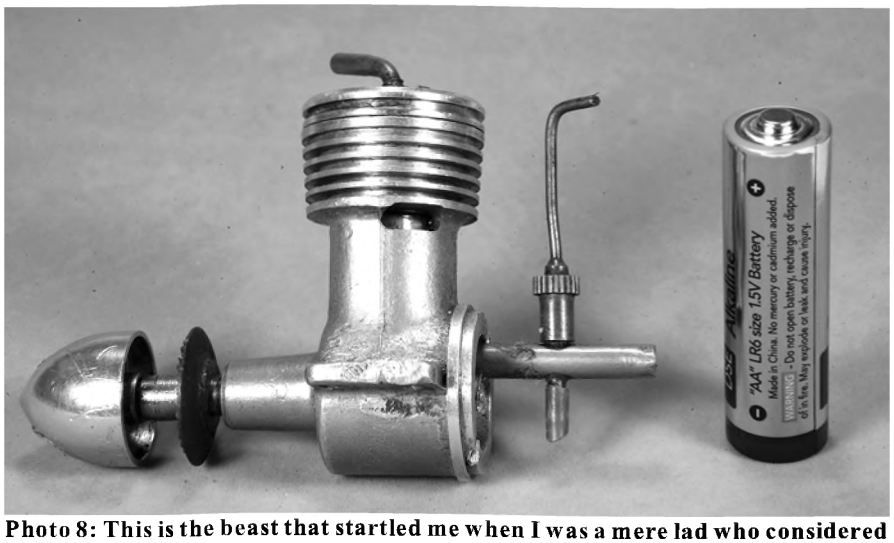


Photo 8: This is the beast that startled me when I was a mere lad who considered a 1cc (0.06 cu in) engine to be quite adequate for modeling needs.

Photo 9: Great name in days past, Veron produced good modeling equipment. These impellers were intended for 1cc engines.

So how come a ducted fan engine runs at such high RPM? First, look at the size of the propeller (or impeller). Engines designed for ducted fan use may have modifications such as a more efficient heat sink head, port timing to suit a tuned exhaust, and a carb to suit high RPM operation, but not much more. In some cases there's a little strengthening of some components such as the conrod, crank pin, and very high speed, extra clearance bearings. They really wring it out when they're in full song, and the sound is a combination of high RPM and the scream of the impeller. This puts an image in the mind of modelers that the engine is a super powerful brute that's trying to get out of the fuselage! As I said, they *are* howling, and have a bit more power than a sport engine of the same capacity, but the power is coming from the higher RPM.

My first experience with this situation was around 1949. I had a free flight model of a Lavochkin ducted fan (the real aircraft was jet powered) that had a monster 1cc diesel engine in it (see **Photo 8**). The impeller was a plywood disc with hard gasket card material blades that were glued into the disc and secured by a ring of wire. When that powerful beast of an engine started, the sound and increase in RPM startled me so much I very nearly dropped the model. As it was I was very glad to launch it so I wasn't in its close proximity in case something exploded. Only a moderate success but it was different and a bit of enjoyment after all. There was a good bit of interest in ducted fan aircraft not long after this and several manufacturers produced ready made fans for the job (see **Photo 9**). Problem was, you had to remove part of the model to start the engine with a cord (bootlace), and due to the frailty of the models, more often than not you ripped the engine out of the airframe - particularly if it was an over-compressed diesel engine. Okay, so your ducted fan engine isn't all that different from a good quality sport engine and can certainly be used for general modeling applications. Actually, ducted fan and heli engines have good application in scale fighter type aircraft that have tight cowls due to the generally larger finning and the heat sink head. It probably wouldn't sound great in a Tiger Moth, but it might make a good power supply for a screaming Mustang.

MORE BALLOONS (SHUDDER).

As mentioned, it's celebration time in the Oily Hand domicile at the time of this writing. In March of 2009, the same as the date on the pages in this magazine, it will be time again for the Oily Hand's birthday. This march I will be 71. Now, some astute readers might remember that I turned 71 in 2008, and will be wondering if a screw or two has vibrated out of the old Oz noggin. Well, the fact is, I hear and read all this nonsense about anti-

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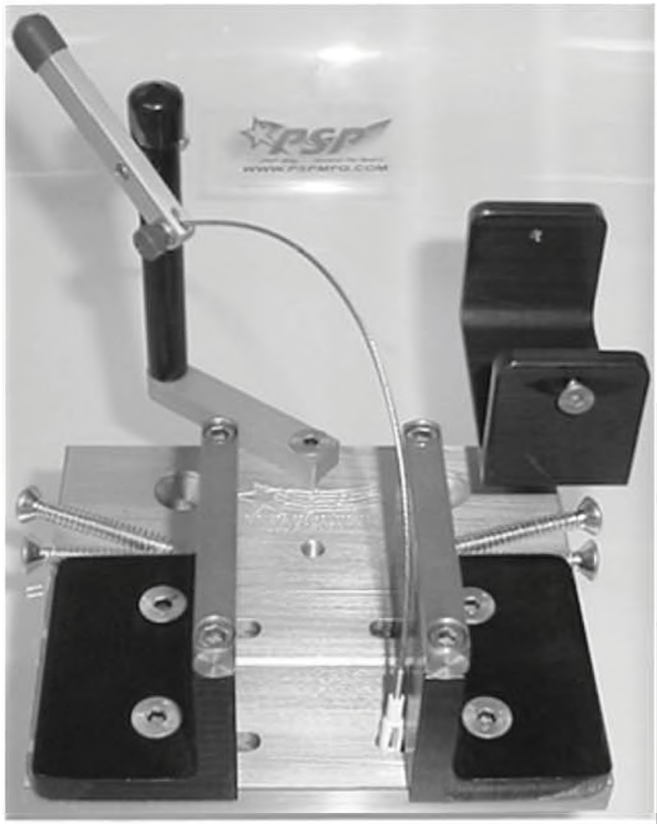

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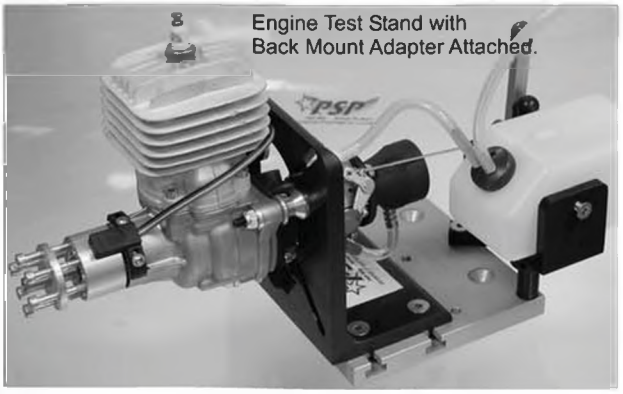

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aging medications, formulas, and methodology but I don't see much in the way of results. Sitting in the 'loobrary' recently I had a good thought. We should all be aware of the amount of junk generated every day, and the need for recycling, and I thought about the calendar on the wall. Rather than have a new one every year, why not re-use the old one? The day and date is only once removed so that's no problem, and the great added benefit is that it's perfect for anti aging. Seeing as how I am now using the '08 calendar in '09, it still indicates that I am only 71! And next year I may be 70 and so on, as I have a great collection of calendars going back many years (I hate to throw anything away that might have a future use). *(Editor's Note: Don't laugh too quickly at Brian. After all, there are only 14 different annual calendars. Seven are for non-leap years, and seven are for leap years, seven each because a new year must begin on one of seven days. Since 2008 was a leap year, its calendar won't be good again for 28 years (2036), but if you saved any 2001 or 2007 calendars, they'll be accurate again in 2018, 2029, and 2035. Those worn old calendars from 1981, 1987, and 1998 are usable this year (2009) and again in 2015. And save those perfectly good 1999 calendars for 2010, and the 2005 calendars for 2011. Brian knows.)*

And since it is that time of the year again, that chunder head, intelligence challenged assistant of mine tried again to bake me a chocolate cake with a difference for my birthday. I certainly do appreciate his kind intention, but I wish he wouldn't experiment. He's been studying old nursery rhymes and came upon the old "Sing a song of sixpence... etc., etc... four and twenty blackbirds baked in a pie." So he decided to bake a cake with 24 budgerigars in it to give it an Oz slant. Obviously he couldn't actually "bake" the cake with the budgies inside (but then again, baked budgie... who knows, might be good) so he inflated a balloon, put it in a cake pan, covered it with chocolate cake mix, then put it in the hot oven. He figured that the cake would cook with a hollow formed by the balloon into which he would stow the budgies. (Imagine 24 budgies crapping inside your birthday cake. That's even worse than the blue bird of happiness crapping *on* your birthday cake!) Well, I guess you can imagine what happened. The heat in the over expanded the air in the balloon, the balloon eventually exploded, blew the door off the oven, and covered the kitchen in chocolate cake mix. Man, I gotta tell ya, it is one awful big mess. I've locked him and the 24 budgies in the kitchen now, and there they will stay until every crumb, dollop of chocolate, and other goo has been removed. And, just as a bonus, they can polish all my cookware while they're at it. That should give me a week of peace. So what say you and I adjourn to my secret laboratory for this month's...

APRILWUN
DOT ROT DOT CON

This section is devoted to weird ideas, overdevelopment's, and interventions from my underground workshop. Warning! Note very carefully that these ideas will incur a big risk to your internal well being, your other family members, your bed bugs and maybe even your favorite fondue fork. Before even considering any of these ideas, you should discuss the matter with the first available mental health professional or somebody else who might also be intelligence challenged or as impaired as yourself if you think this is real. In other words, this is a put on, not a project you can safely attempt. Do not believe anything you read and see here, for nothing in that section is real or wholesome, other than me, that is. And pay no heed to the editorial comments as these are merely a fragment of my imagination.

I live about 20 minutes drive from Lucas Heights, the Atomic Energy Commission where the possums in the trees glow green and have four eyes. I drop in every so often to see what is bubbling in the cauldron, and if necessary to adjust the caesium clock to align with the time indicated by my Boy Scout fob watch (rub the hands together and you can start a fire, too). Last week one of the scientists gave me a paper bag full of old charged particles, and a pop bottle full of stratosphere, which is the atmosphere way above the gravitational pull on earth. The astronauts collect this by holding bottles out the window of the space ship on their way to the satellite stations. The stuff I got is really good as it was collected on the dark side of the moon where all traces of gravitational influence have been eliminated. I mixed the particles and the stratosphere gas with a gallon of modeling dope, and I could feel the can getting lighter and lighter as I stirred. I then painted a thin coat on a hand-launched glider, let it dry, and then hurled it out the window. Up it went like a rocket, and was out of sight in minutes. Wow, this is good stuff! I next used it on an old .40 powered lead sled (a grossly overweight model) and it flew like a featherweight. This is the best anti gravity formula I have tried in ages! I intend to market this stuff, "The Oily Hand Anti Gravity Dope for Dopes", but it comes with a warning. If your engine is not reli-

able and cuts out in flight, say goodbye to your model as without the power to fly it back to the runway, it will just drift upwards and join all the other space junk floating around up there. Watch for the ads if you're interested.

Just one more sparkling idea from Winch, the well founded Wiz.

MAYDAY! MAYDAY!

Well, there I was, sitting in my window seat enjoying the *"R/C REPORT"* flight, when Captain Banks suddenly announced the emergency: "Undo your seat belts, folks, the starboard advertiser has just fallen off!" Well now, that upset me a bit, so I adjusted my seat and looked out the window again to see that the starboard wing was indeed at a serious list. Then came, "Bail out! Bail Out! The port advertiser has just fallen off, and the rivets are popping from the fuselage!" Well now, this was very serious stuff, as I had planned on continuing on this great trip until at least my 99th birthday. But now, there I was, my seat pulled out from beneath me with no hope for a parachute. I tell you, this is a serious blow as I had just about learned to understand you blokes and the commands from Captain Banks.

This is a bloody poor show, and I'm so pissed off I think I'll go outside and swear at my pet funnel-web spider. What's going to happen now to my underground workshop? Who will yell at my fuzzy-brained assistant? Apparently it's a done deed with no one to fight, so I'm really going to miss reading all the "good stuff" from my fellow writers, and the italicized comments from "he who has the last word".

I am still connected to you blokes on the big island, however, by the umbilical cord of the jelly bean box *(Editor's Note: Translation: Internet and computer.)*, so my answers and comments will still be available from the same email address. If you want to, take note now and keep in touch.

Thank you, Gordon. It was a great flight while it lasted, and I've never enjoyed writing more than for the readers of *"R/C REPORT"*. Take care, and be well.

-Brian Winch
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Lurnea, NSW
Australia 2170
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"Spread Spectrum Radios" How Good Are They?

A sea of Spektrum DX7 transmitters in my testing environment. Or is it a flock?

by Cal Orr

We once applauded the then new AM dual conversion receivers. Then came FM, and later PCM. We said each one was promising, and time has proven most of those claims correct. They were good then and they still are. But now we have Spread Spectrum (SS), with promises and instant acceptance like nothing before. After all, interference-free flying is a strong selling point, and not having to deal with a long receiver antenna wire is okay too. And while we've seen several articles written on SS *theory* (I've published two myself), where are the actual tests?

I decided to test them in three phases; lab tests, ground range tests, and flight tests. Each phase first used only one SS transmitter, and then as many as 40 (yes, forty!) SS transmitters, all turned on.

In the lab I measured "response time", how long it takes the servos to respond to the transmitter commands. I've heard some good claims, but what are the manufacturers really telling us? Is it just the RF link, or is it overall system performance? To measure what I'll call "response time", I built a special circuit (**Photo 1**) that plugs into a receiver like a servo. This way the *mechanical* speed of a servo wasn't a factor. My circuit uses an analog servo amplifier whose output connects to an opto-coupler, and a chip to clean up the pulses for viewing on an oscilloscope. The opto-coupler isolates the receiver's ground from that of the transmitter and oscilloscope. I then

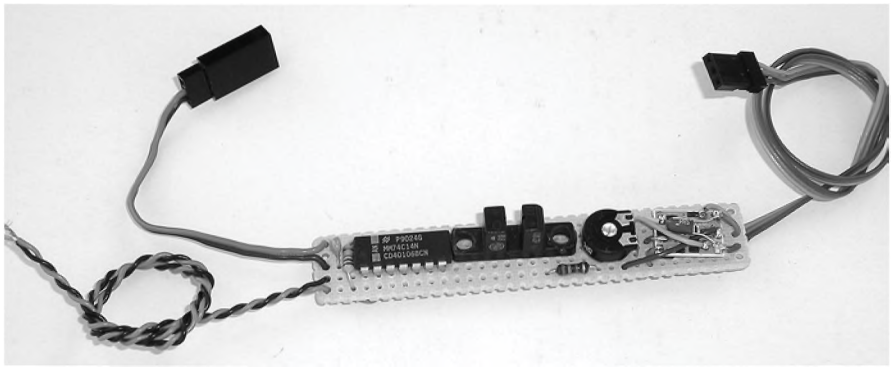


Photo 1: Circuit built to aid in measurements of "response time". This circuit is basically a servo amplifier (right) with an opto-coupler and a chip (left) to clean up the pulses. This circuit plugs into the receiver's landing gear channel, requires its own battery, and the output to be viewed on the oscilloscope comes from the black and orange wires.

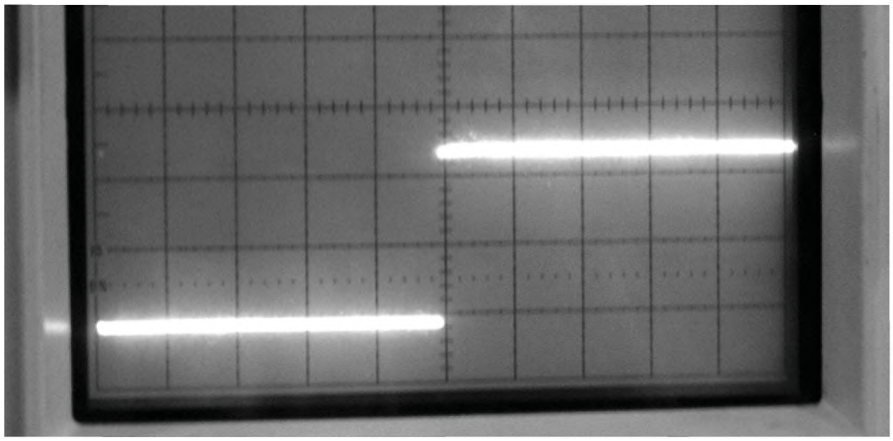


Photo 2: "Response time" as viewed on the oscilloscope. Oscilloscope is set up at two volts/division (vertical) and five millisecond/division (horizontal). The landing gear switch was operated which triggered the trace to start moving across the screen. The jump to five volts (from servo amp circuit output) occurred in about five divisions or 25 ms.

TRANSMITTER TESTED	RESPONSE TIME (ms)
Kraft KP7C (made in 1976) analog AM	05-15
Futaba T6EX 2.4 GHz system	18-35
JR 8103 72 MHz w/PPM FM receiver	20-40
JR 12X 2.4 GHz system w/12-ch Rx	25-40
Spektrum DX7 2.4 GHz system	25-40
JR 9303 2.4 GHz system w/R921 Rx	29-45
JR 9303 2.4 GHz system w/AR9100 Rx	30-50
Futaba 7C 2.4 GHz system w/R617FS Rx	35-50
JR 8103 72 MHz PCM system	35-70
JR 8103 (or 9303) w/XPS 2.4 module	45-70
Airtronics RDS 8000 2.4 GHz system	48-65
JR 8103 72 MHz w/DM9 2.4 GHz module	50-70
JR 9303 72 MHz with DM9 2.4 GHz module	55-70

Table 1

connected the oscilloscope's trigger to the landing gear toggle switch, so how fast I moved a joystick would not be a factor. Most landing gear switches have only two wires (ground and signal) and two positions (low (0) or high (1)). The oscilloscope was set to trigger only on a "positive slope" (the "0 to 1 change") of the switch. I also verified that the update time (frame rate) of the gear channel was the same as the primary channels. (Some PCM radios update the primary channels more often than the auxiliary channels.)

So, the landing gear switch triggers the oscilloscope and starts the trace on the screen. At some point the trace jumps to five volts from my servo amplifier, and the "response time" is how far the trace travels before the jump to five volts, as seen in **Photo 2**.

First I noticed that the tests did not give a *fixed* time, but a *range* of values that varied as much as 20 to 30 milliseconds (ms). When the landing gear switch is hit, the transmitter signal could be anywhere in the pulse frame, since the action of the switch is not synced to the beginning of a frame. This really is like real life flying!

Some may argue that there may be errors in my methodology, but any such errors would be repeated from test to test, so I still believe the results provide a valid comparison. I am, however, only *assuming* that each transmitter tested is a fair representative of that type.

Table 1 shows the results of my "response time" tests.

Then we did the tests again, but with up to 40 SS transmitters (Spektrum DX7's) all turned on at the same time! This was to see if the added signals would cause a slower response time. In theory I expected to see an increase in the frequency-hopping systems like the Futaba T6EX, but even with all 40

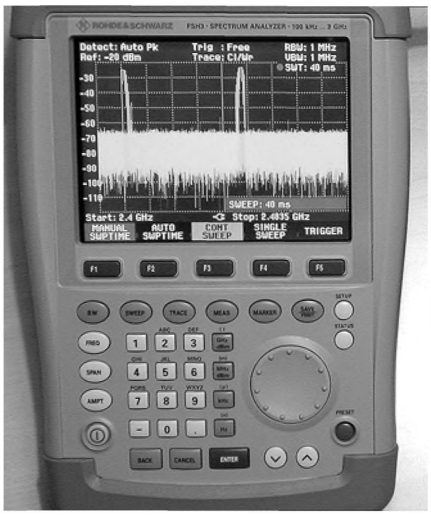


Photo 3: Spectrum Analyzer set up to view frequencies 2.40-2.4835 GHz. The two spikes are the frequencies chosen by a single Spektrum DX7 transmitter.

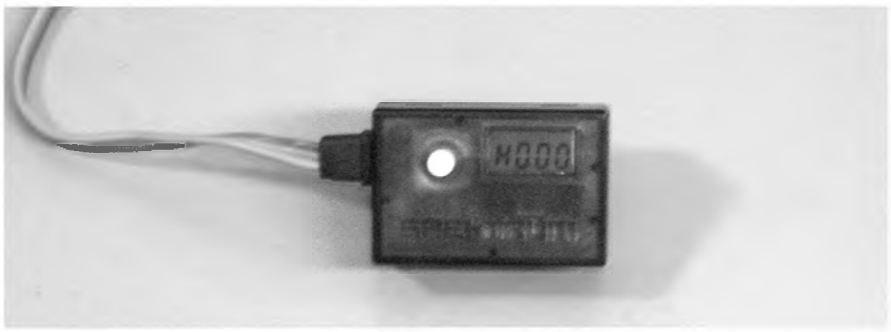


Photo 4: Spektrum Flight Log display shows H000 here, indicating no holds.

DX7's turned on, *none* of the systems showed a noticeable increase! Note that the test transmitter was within a few feet of its receiver, since both were connected to the oscilloscope, and the 40 DX7 transmitters were as close as I could get them to the test radio.

Why 40 transmitters? Our SS band runs from 2.400 to 2.4835 GHz, and is divided into 79 separate 1 MHz frequencies. Since the JR/Spektrum transmitters use two frequencies at once, one might think that 40 transmitters would use up the entire band (and then some). It may seem that 39 such systems could safely be used at one time, but #40 would *not* link up or operate (thus leaving the first 39 systems alone). This, however, is not the case, as we had as many as *45 SS* transmitters operating properly at one time!

Note that all of the DX7 transmitters were charged, and their outputs verified with a spectrum analyzer. (**Photo 3** shows the output of one Spektrum transmitter)

Next came ground range tests to see the effects of antenna placement and orientation, and other metal obstacles. I also wanted to see if "up to 40" interfering transmitters would cause a ground range reduction. (Most radio manufacturers recommend keeping all internal wiring well away from the receiver antenna(s) in our models, and we made every effort to do so.)

The first ground range tests were made as recommended by the manufacturers, with the model on the ground while the transmitter was carried away. Most manufacturers recommend 30 paces (about 90') with a reduced output caused by "holding a button". My spectrum analyzer verified that, during a range test while the button on the back of the transmitter is pressed, the amplitude of the signal was significantly reduced. Every system passed *this* range test, but I took it even further to see just where control *was* lost. Sometimes you'll find a dead spot in the range test, but you can often walk through it to determine the true maximum range. (There should be no dead spots in the first 30 paces, however). We also tested to see if the maximum range was affected by the position of the transmitter's antenna. In all cases the range was reduced when the transmitter's antenna was pointed directly at the model. (We see this with 72 MHz systems, too.) Then metal barriers were placed between the transmitter and the airplane; a large metal coffee can, a car, and then a large metal garage door. All of them reduced the maximum range, but never to less than the recommended 30 paces!

Then we did the tests again, *exactly as before*, except now with up to 40 DX7 transmitters turned on, all within a few feet of the airplane. Again, all systems showed a significant reduction in range as more DX7's were turned on.

Most systems began showing a loss of range when 10-15 DX7's came on. In fact, only the JR9303 with the AR9100 "Power Safe" receiver (using *four* remote receivers!) remained steady beyond 30 paces with 40 DX7's turned on. The other JR/Spektrum systems and the XPS 2.4 module/Rx were a close second. The Futaba T6EX had the least range in this test, yet it was still perfectly acceptable! *And keep in mind that this was with 40 other transmitters operating close by!* (Note: Consider the number of paces approximate, as every time I perform a range test I get slightly different results.)

Note: The ($360) JR/Spektrum AR9100 "Power Safe" receiver consists of a power distribution module to which we can connect up to four remote receivers placed at different spots in the fuselage. These four remotes, each in a slightly different RF environment, likely accounts for its superior results in the range tests.

Now it was time to fly the test airplanes in a predictable manner; hold altitude and fly a repeatable oval around the field. Since the receiver might go in and out of hold without the pilot even noticing, the ovals were flown with constant left and right wing rocking so we could detect any receiver holds. Our pit

Columns: IT=how many Interfering Transmitters were turned On, NU=Not Used
Volts=Receiver Voltage, A, b, L, and r = the antenna fades each of the four remote receivers
F=the number of frames lost, H=the number of times the receiver went into Hold

Flight #	**IT**	**Volts**	**A**	**b**	**L**	**r**	**F**	**H**
JR9303 2.4 GHz transmitter and R921 receiver								
Flight 1	0	6.2	0	8	NU	7	NU	0
Flight 2	10	6.1	12	10	NU	5	NU	0
Flight 3	20	6.1	5	4	NU	7	NU	0
Flight 4	30	6.1	9	19	NU	28	NU	0
Flight 5	40	6.1	21	8	NU	8	NU	0
Note: I've been told that our R921 receiver had a software problem that allowed the frame loss counter to run away. This has been corrected.								
JR9303 2.4 GHz transmitter with AR9100 Power Safe receiver with four remote receivers								
Flight 1	0	6.3	0	0	0	1	0	0
Flight 2	10	6.3	0	1	0	0	0	0
Flight 3	20	6.3	0	4	12	16	0	0
Flight 4	30	6.2	10	13	14	38	0	0
Flight 5	40	6.1	22	20	21	23	0	0

Table 2

area and 40 DX7 transmitters were at the west end of the field, with the pilot about 350 feet away, to allow flying the plane right over the 40 transmitters while the pilot was some distance away. We wanted to see how many interfering trans-mitters we could turn on before the pilot noticed a hold or hit.

The flight tests tended to mimic the ground range tests. The Futaba T6EX seemed to become sluggish or slow with about 20 other transmitters turned on. It took several hits when 30 DX7's were turned on, and we began feeling unsafe at 35 transmitters.

The JR8103 with a DM9 2.4 GHz module, the Spektrum DX7, and a JR9303 with an XPS module, all had hits when 35-37 DX7's were turned on, but we had acceptable control even with all 40 on. We also noticed that in some cases turning on an additional transmitter was precisely when a hit was noted by the pilot! Once the number of interfering transmitters remained constant, however, no additional hits were noted.

The same tests were then conducted with a JR 9303 transmitter using an R921 receiver (two internal receivers with one remote receiver), and the AR9100 Power Safe System (with all four remote receivers, an amazing package!). We were able to fly both of these systems with all 40 interfering transmitters turned on, but we were unsure if we felt hits or not!

Spektrum offers a device called a "Flight Log" (see **Photo 4**) that connects to the data port of their 9-ch receivers. After a flight, but before you turn off the power, this device will show seven measurements taken during the flight; receiver battery voltage, the number of antenna fades for each of the (up to four) remote receivers, the number of lost frames, and the number of holds.

We then made five flights each with the R921 and AR9100 receivers, each consisting of three large ovals around the field. The first was with no other transmitters on, then with 10 turned on, then 20, until the 5th flight was with all 40 DX7's turned on. The results are in **Table 2**. The column headings are defined at the top of the table.

According to the Flight Log, neither of these receivers ever went into hold, so we tested the Flight Log to make sure it was working, correctly, and it was.

Several consecutive frame losses will cause the receiver to go into hold, which did not occur. Since about 50 frames of information are transmitted every second, our six minute flights used nearly 18,000 frames. According to the data for the AR9100 Power Safe receiver, we had *zero* holds and lost frames! We see that each of the four remote receivers took hits, but apparently not all at the same time, which is the precise advantage of *having* four remote receivers. I must say, I am very impressed with this receiver. This is truly the most robust RF link I have seen under such harsh testing. I *want* one!

ROUND TWO

It is important to note that in the tests so far, the source of "interference" came from one to forty Spektrum DX7 transmitters, a direct sequence system with redundancy, using two fixed frequencies. In Round Two I repeated the tests as closely as possible, but now using 20 Futaba T6EX 2.4 GHz FASST frequency-hopping trans-

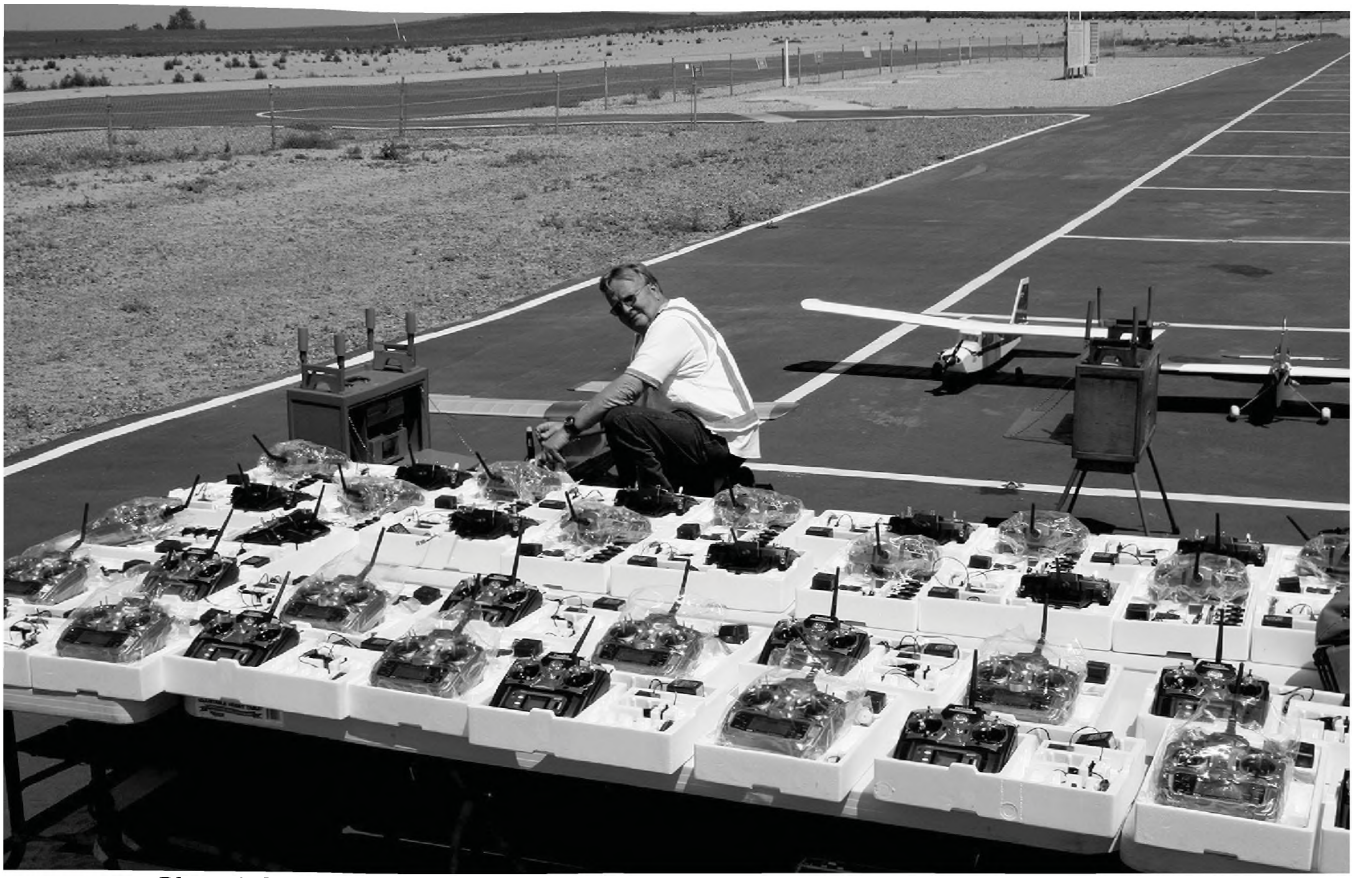


Photo 4 shows the table of 40 "interfering transmitters", now 20 Futaba and 20 Spektrums.

mitters, and 20 DX7 transmitters (see **Photo 4**). The point was to see if the mixture had a different effect on the one system being flown.

We also got a new Airtronics RDS8000 2.4 GHz system to test, so we tested its response time as described at the beginning of this article, measuring 48-65 ms.

Then we did ground range and flight tests on the following; Airtronics RDS 8000 2.4 GHz system, JR 8103 w/DM9 module and a JR R921 receiver (using two internal receivers and one remote receiver); a JR 9303 transmitter with the DM9 module and an AR9100 Power Safe receiver (using four remote receivers).

In the ground range tests the airplane was on the ground, and the transmitter was walked away. Just 5-10' from the airplane was the table holding the 40 interfering transmitters. This makes a *very* harsh test! (Nor was it easy on us, having to maintain and monitor so many transmitters!). Again, all ground range tests were performed with a reduced transmitter output (usually by holding a button), and each system was tested to its *maximum* range as well as the recommended "30 paces." First the tests were done with no other transmitters turned on, and then tests with varying mixtures of other transmitters turned on, ten at a time (five Futabas and five DX7's).

The Airtronics system had a good ground range test, not becoming sluggish until around 60 paces, and a max range around 80 paces, all well above the minimum recommended. But with 20 Futaba transmitters turned on, The Airtronics' max range dropped to about *six* paces. With only five Futaba's turned on, however, the ground range was again 30 paces. With five Spektrum DX7 systems turned on, the Airtronics ground range was about 25 paces.

Still with the Airtronics system we then used a mix of Futaba and Spektrum transmitters, turning them on in groups of ten (five each). With 10 interfering transmitters on, the ground range was about 12 paces. With 20 other transmitters on, ground range was only 1-2 paces. With 30 transmitters on, I had to be right on top of the model to have solid control.

With all other transmitters off, the Airtronics ground range went right back to about 80 paces. Also, if I moved the Airtronics airplane further from the other transmitters, its ground range improved. We are assuming that the Airtronics system we had is typical of its type.)

I then rolled the airplane with the JR R921 Rx into the same spot where the Airtronics airplane had been, just 5-10' from the table of 40 transmitters. Its max range with no other transmitters on was over 120 paces. With all 20 Futaba systems on, the ground range was

Photo 5: The plane was flown (often right over the table of transmitters) with a constant wing rocking so the pilot could detect any problems.

still over 120 paces. With a mixture of other transmitters on, we measured the following:

Interfering Transmitters	Number of paces
10	95
20	60
30	50
40	32

Note that the ground range test results with all 40 interfering transmitters on! The ground range was still beyond the recommended minimum! These multi-receiver systems work very well!

Next came the Spektrum AR9100 receiver with its *four* remote receivers. Max ground range was again over 120 paces, with or without the 20 Futaba systems turned on! Then using a mixture of Futaba and Spektrum transmitters on, we measured...

Interfering Transmitters	Number of paces
10	120
20	120*
30	97
40	65

(*but sluggish and with chatter)

Now it was time to fly again, with the table of 40 interfering transmitters at the west end of the field, while the pilot was about 350 feet away. The plane was flown in a large oval, at times right over the transmitters table (see **Photo 5**). The plane was flown with constant rhythmic left and right wing rocking so the pilot could note any receiver holds or sluggish responses.

While the Airtronics airplane was flown, we turned on other transmitters two at a time. The pilot experienced control difficulty with 16 interfering systems. All the other transmitters were then turned off, and then we turned on five Futaba at a time. Once 15 Futabas were on, the pilot had so much trouble we turned the Futaba off and landed the airplane, concluding the Airtronics testing.

We then made five flights each with the JR R921 and AR9100 multi-receiver systems. The first flight was with no other transmitters on, progressing up to the fifth flight was with all 40 transmitters on. The interfering transmitters were again turned on in groups of ten, five Futabas and five Spektrums. With the 9-ch receivers we were again able to use Spektrum's "Flight Log" device. The results of those ten flights are in **Table 3** (see following page), where the columns are described at the top.

This data shows that neither receiver ever went into hold, even when flying close to the 40 other transmitters while the pilot was about 350 feet away. Why both receivers seem to perform better with 30 other transmitters turned on than with 20 is easy to answer: I have no idea!

My biggest surprise was with the AR9100 Rx during the flight with all 40 other transmitters turned on. The total number of antenna fades was 129, while the same test (as close as we could repeat it) with the JR R921 Rx had only 57. This also showed up in Round 1's testing with 40 Spektrum DX7's. With all 40 DX7's on the total antenna fades for the JR R921 was only 37, while the AR9100 had 86.

I agree that we created a *very* harsh environment. Some will say it's "unrealistic", since when would you ever have 40 other transmitters turned on (and confined to a couple of tables) with the pilot's transmitter about 350 feet away? Nevertheless, all of our test systems were tested in this same environment.

It doesn't seem all that long ago that I was flying 72 MHz systems with a homemade frame loss counter, and was happy when a six minute flight had less than 100 lost frames! The two 9-ch JR/Spektrum systems we tested here are truly the most robust RF link I have ever seen under such harsh testing.

(Editor's Note: Although they still wouldn't be confined to one or two tables, I can imagine a situation where 40 transmitters might be operating simultaneously. Many flying events don't impound the new 2.4 GHz transmitters, so it's not unfeasible that in addition to maybe six pilots flying, 34 others might have their transmitters turn-

Columns: IT=how many Interfering Transmitters were turned On, NU=Not Used
Volts=Receiver Voltage, A, b, L, and r = the antenna fades each of the four remote receivers
F=the number of frames lost, H=the number of times the receiver went into Hold

Flight #	IT	Volts	A	b	L	r	F	H
JR8103 w/DM9 2.4 GHz module and JR R921 receiver								
Flight 1	0	5.4	7	9	NU	0	NU	0
Flight 2	10	5.4	4	0	NU	24	NU	0
Flight 3	20	5.3	10	5	NU	3	NU	0
Flight 4	30	5.3	8	1	NU	5	NU	0
Flight 5	40	5.2	20	18	NU	19	NU	0
Note: Due to previous software problems, I no longer trust the "Flight Log's" frame loss counter.								
JR9303 w/DM9 2.4 GHz module and AR9100 Power Safe receiver with all four remote receivers								
Flight 1	0	6.8	0	2	0	1	0	0
Flight 2	10	6.8	0	2	0	0	0	0
Flight 3	20	6.7	7	32	8	7	0	0
Flight 4	30	6.7	8	5	1	4	0	0
Flight 5	40	6.7	37	41	26	25	1	0

Table 3

ed on while working on their airplanes. Hey... it's possible!)

IN FLIGHT RANGE TESTS

I'm often asked, *"What's the maximum range of our R/C systems?"* And now I also get, *"Do the new 2.4 GHz systems have the same range as the 72 MHz systems?"*, and *"What about the Park Flyer 2.4 GHz systems?"*

Some people drive away from the transmitter with the receiver in a car, or put transmitter on one hill top and the receiver on another, etc. But these are still "ground range tests." For "flying range" tests, I decided to carry the receiver and servos up in a full-size plane while the transmitter was on the ground, just like when we fly.

I've been full scale pilot about 35 years, mostly in a single engine, six passenger Cherokee. All I had to do was to install the receivers, servos, and batteries in the Cherokee, and have an R/C pilot on the ground with the transmitter. I could measure the distance first with a GPS unit, and verify it with the airplane's Distance Measuring Equipment (see **Photo 6**).

Photo 6: On final approach to land, the runway is just behind the upper left corner of the GPS unit. The small numbers in the upper right corner of the GPS unit show that I'm 1.4 miles from the R/C pilot. Just to the left of the plywood is the altimeter, indicating about 1650'. The airport's ground altitude is 1450' so I'm only 200' high. The plywood has three servos and three batteries, one for each system. The AR9000 receiver has a "Flight Log" attached so we can look at lost frames and receiver holds.

I wanted to mount at least the receivers *outside* the Cherokee to prevent its aluminum skin from blocking the transmitter's signal. I mounted three receivers on a piece of PVC plastic (see **Photo 7**). I used a JR R790S PCM 72 MHz on ch-49, a Spektrum AR6100 2.4 GHz Park Flyer receiver, and a Spektrum AR9000 2.4 GHz 9-ch receiver. The PVC was mounted to the side-step of the Cherokee, placing the receivers just below and to the right of the airplane. Wires were then run from the receivers into the airplane where I had the servos and batteries. In most cases, only one connector was plugged into each receiver's aileron channel. Inside the airplane I used

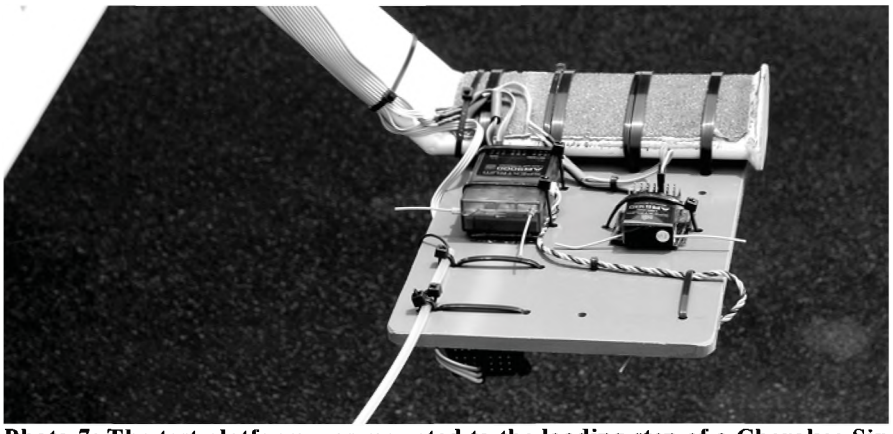


Photo 7: The test platform was mounted to the loading step of a Cherokee Six airplane, with the three receivers. Note the tube for the 72 MHz antenna.

a Y-harness for the battery and one servo. I used a second connector with the 9-ch receiver, so I could also use the "Flight Log" to observe lost frames and "holds". Inside the airplane I could turn each receiver or and off at will.

The flight range tests were done in So. CA, first over the desert, and later over a large city to see if the city's higher noise floor had any effect on the range. In each case the RC pilot was on the ground at a spot marked on the GPS. He had a JR 72 MHz SPCM transmitter on ch-49, and a Spektrum DX7. He would constantly operate the aileron sticks left and right. To give a true comparison between the full-range and Park Flyer *receivers*, both were bound to the same DX7 transmitter.

In the desert I had to taxi to the end of the runway, where the GPS indicated 1/2 mile from the R/C pilot. Both full-range systems were operating just fine at this point, a very pleasant surprise! (The Spektrum Flight Log attached to the 9-ch 2.4 GHz system did indicate several antenna fades and a couple lost frames.) The Park Flyer system stopped working at around 1/4 mile (this is still ground range).

The traffic pattern here is a right hand pattern, and the receivers were on the right side, so the airplane was never between the transmitters and receivers.

In flight, the maximum range for the Park Flyer system was just over one mile here. The 72 MHz system was good to about 2 miles, and the 9-ch 2.4 GHz system was good to about 3.2 miles.

For the tests over a large city I used a Cessna. The PVC platform with the receivers was fixed to the right main landing gear strut, again placing the receivers below and to the right side of the airplane.

This airport has a left-hand traffic pattern, so the first turn after take-off placed the airplane itself between the transmitters and receivers. All three systems showed some interruption during the turn, at 1.2 miles from the transmitters. The rest of the flight was flown at 1000, 1500, and 2000' above the ground, all while keeping the receivers on the same side as the R/C pilot. Every time we did these range tests we got slightly different results, and there seems to be nulls at some points. While flying in a straight line, a system would stop operating at some point, and then start again at a greater distance! I also made note that when I flew directly over the airport at 2000', the GPS indicated 0.4 miles, so the known altitude was taken into account in my measurements.

My data also indicates that the range increases slightly with altitude. The 9-ch 2.4 GHz system had the greatest range, at just over 3 miles. The 72 MHz system had a range of about 1.8 miles, and the Park Flyer system had a range of about 1.3 miles.

Even with a giant scale model, I don't think we typically fly more than 1/2 mile from ourselves. After all, we have to *see* our model well enough to know its orientation in order to control it.

Later I flew with three more systems for the flight range tests, an Airtronics 6 channel 2.4 GHz system, an XPS 2.4 GHz module in a JR 10X transmitter, and a Futaba 7C FASST 2.4 GHz system. These tests were conducted the same way, but only over the big city. The PVC mount, the Cessna, time of day, weather, and location of the R/C pilot were all the same.

First I taxied out to the run-up area about 1/5 mile from the R/C pilots. Another airplane was behind me, placing it between the receivers and the R/C pilot. Here the Airtronics system was still working fine. The Futaba system was a little jittery, but the XPS system wasn't working at all.

Out on the runway all three systems worked fine. Then I *lost* all three during the left turn which placed the Cessna fuselage between the receivers and the R/C pilot. While flying directly over the airport at 1000' (the GPS indicated 0.2 miles) all three systems were working just fine. As I flew farther out, I always kept the receivers on the side towards the R/C pilot. The Futaba and Airtronics systems were good to around 1.5 miles, but the XPS system quit at about 1.2 miles. Since these results were less than expected, we again tested a JR system, this time using a 10X with a 2.4 GHz module, coupled to a brand new AR9000 9-ch unit with four remote receivers. I again taxied to the run-up area, and again another airplane was behind me, placing itself between the trans-

My latest model, this 38% scale Great Planes Extra 330S, now uses a Spektrum AR9100 "Power Safe" receiver!

mitters and receivers. Like the Airtronics and Futabas earlier, the JR system was fine. We then flew 2.8 miles before the servo got jittery.

In our flight range tests, we used two different JR AR9000 receivers (each with four remotes), one with a DX7 transmitter, and one with a JR 10X transmitter equipped with a JR 2.4 GHz module. In both cases, the maximum range was nearly twice that of the other systems.

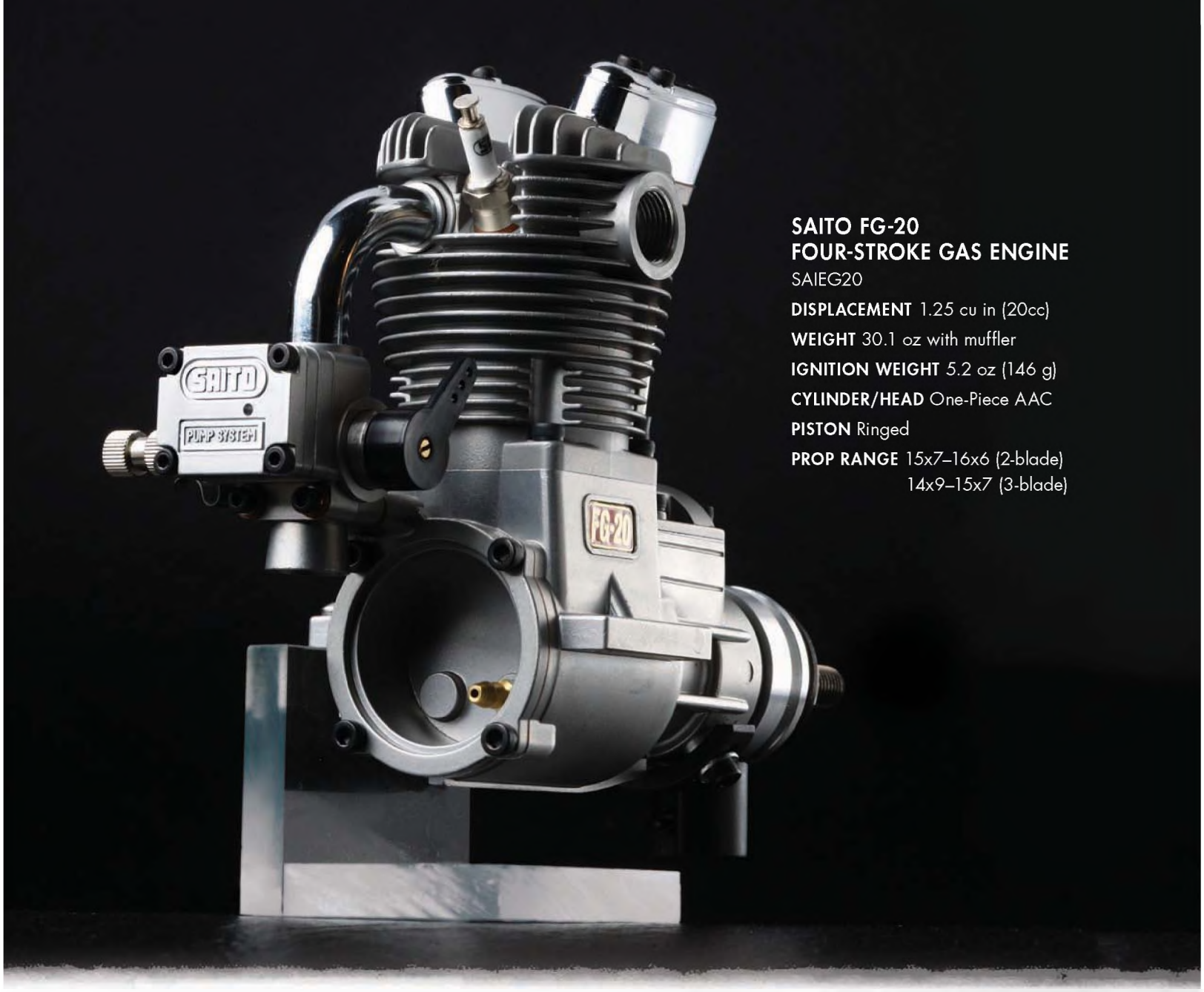
I've presented this data for informational purposes only, in hopes that you may feel comfortable knowing that our R/C systems can operate at such distances. During these tests, however, except for the AR9000 four-receiver system, we used only one example of each R/C system, and we're assuming that each was typical for that brand and model.

I would like to thank Hobby Club USA, Steve Parola, and Lonnie Morrison for four long days of help during these tests. Do you know how long it takes just to charge and bind 40 R/C systems? Hobby Club USA also provided the fuel and three R/C airplanes, all of which made it home safely! I also want to thank the Pomona Valley Model Airplane Club for the exclusive use of their field during the flying tests, and the AMA (especially Jay Mealy) for their support (and their Spectrum Analyzer).

I also want to thank Horizon Hobby's Eric Meyers and Steve Goodreau for providing some the R/C systems to be tested, and the 40 Spektrum DX7 systems used for interference, and for then stepping back to allow us to conduct our own tests.

Finally, I would like to thank Lonnie Morrison again, Ron Meyer, and Charles Mitchell for their help in conducting the in-flight range tests.

-Cal Orr
calorrflyrc@hotmail.com



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)

THE FIRST 20CC FOUR-STROKE GAS ENGINE IS HERE.

TAKING GAS POWER WHERE IT'S NEVER BEEN BEFORE

The wildly innovative FG-20 brings Saito's unmatched reputation for quality and dependability in the four-stroke glow market to gas enthusiasts everywhere. Based on the lightest 1.20-size engine available, it is the perfect choice for all .60- to 1.20-size aircraft.

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.

By combining the reliability of gas with the sweet sound of Saito, advanced technology and foresight are once again helping Saito lead the way into the future.

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SAITO™

* Decreased operating costs of up to 90% over nitro engine performance. Based on fuel consumption and price per gallon.

HORIZON HOBBY

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

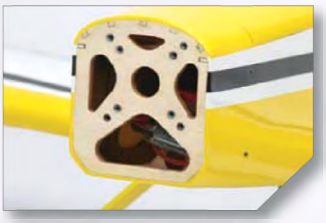
This Aerobatic Pulse is Perfect for the Sport Modeler

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).

HANGAR 9®

Sundowner 50

A Product Test Report by Gordon Banks and Tony Coberly

Shown by Subrena Laten

Model Reviewed..... Sundowner 50
Airplane Type..... ARF Sport Racer
Manufacturer..... Hangar 9 (Made in China)
Distributor..... Horizon Hobby Inc.
4105 Fieldstone Road
Champaign, IL 61822
(212) 352-1913
www.horizonhobby.com
Suggested Retail Price..... $299.99
Typical Street Price..... $199.99
Wing Span..... Advertised: 63"
Measured: 63"
Wing Area..... Advertised: 572 sq.in.
Measured: 575.65 sq.in.
Advertised Weight..... 6 to 7 lbs.
Airfoil..... Symmetrical
Wing Structure..... Built-up balsa and plywood
Wing Joiner Method. 3/4x17-3/4" aluminum tube
Fuselage Structure... Built-up balsa and plywood, with a fiberglass turtle deck, and a pre-assembled and painted plastic and plywood removable cockpit and hatch cover.
Fuselage Length..... Advertised - 47.40"
Measured - 47.38"
Pushrod Type..... Steel wires
Pushrods Installed..... Guide tubes only
Hinges Included..... Yes
Hinges Installed..... All but elevator
Recommended Controls... 4 (Ail, El, Rud, Throt)
Recommended Engine..... .40-52 2C, .56-82 4C, or Power 46 (or equivalent) electric motor
Engine Mount Installed..... No
Engine Mount Type..... Two-piece composite
Fuel Tank Included..... 11 oz.
Landing Gear Installed..... No
Wheels Included..... Two 2.5" mains, 1" tail
Assembly Instructions. 44 page 8.5x11.25" booklet
Hardware: Metric or SAE..... SAE
Hardware Included..... Orange plastic 2.5" spinner; two-piece composite engine mounts with mounting hardware; four 1.88" stand-offs (with 2.25" bolts) for electric motor; pre-painted and trimmed fiberglass cowl and wheel pants with fasteners and helmet-head pilot figure; pre-assembled 11 oz. fuel tank with 5.75" fuel lines; two 14" Zip-ties; a pre-assembled and painted plastic and plywood removable cockpit and hatch cover; built-in servo trays; all required pushrod materials and connectors (plus one EZ connector); pre-installed nylon control horns; pre-installed aileron and rudder hinges; CA hinges for elevator; split-elevator joiner wire; pre-painted aluminum main gear with axles and wheel collars; pre-formed and pre-installed tail wheel assembly; two thumbscrew-type nylon wing bolts; lots of miscellaneous nuts 'n bolts; two decal sheets; one metric Allen wrench (for the Evolution carburetor).
Items Needed To Complete.. Propeller, 4-ch radio, two 1" long servo arms and four 6-10" servo extensions (or two extensions and one Y-harness) for the aileron servos; some scrap balsa or plywood to make a fuel tank retainer and a firewall cover-plate (see text), and silicone sealant to fill the unused holes in the firewall.
Glow Power: Engine, fuel filler, five servos
Electric Power: Motor, ESC, battery, four servos
Covering Material..... UltraCote
Drilling Required..... Yes
Fuel Proofing Required..... Yes (see text)
Estimated Skills Required..... Experienced
Assembly Tools Required. Typical modeling tools, to include a power drill with assorted drill bits, and a Dremel-type rotary tool with assorted bits.
Adhesives Required Thick & thin CA, 30-min epoxy

COMPLETED MODEL

Finished Weight (RTF, dry). 5 lbs. 14 oz. (94 oz.)
Wing Loading..... 23.51 oz./sq.ft.
Engine Used..... Evolution .52NX (18.06 oz.)
Propellers Used..... Evolution 11x6, APC 10x7, and an APC 9x10
Propshaft to Ground..... 8.75"
Fuel Tank Used..... As supplied
Radio Used..... Spektrum DX7 transmitter, Spektrum AR9000 receiver, four JR DS821 digital servos, one JR ST47 servo (throttle), a Spektrum 4-cell 1100 mah NiMH receiver battery, and a JR Deluxe power switch.
Covering/Finishing Used..... Comes pre-covered
Special Items..... SonicTronics long servo arms for the aileron servos

CHEERS - Good packaging to prevent shipping damage; excellent workmanship on pre-built sub-assemblies; beautiful fiberglass cowl, wheel pants, pilot head, and turtle deck; most hinges and all control horns are pre-installed; good quality hardware; instructions include steps for 2C and 4C glow engines and for an electric motor; excellent parts fit; pre-drilled holes for servo mounting screws; removable cockpit for easy radio access; pre-fitted cowl; quick and easy to assemble; excellent color matching (even the plastic spinner!); very attractive finish; slightly lighter than advertised; flies like a fast sport plane, easy to take-off, fly, and land.

JEERS - Numerous errors in the instructions.

General Notes

The Hangar 9 ARF Sundowner 50 is a sleek, thin-wing pylon racer design that's reasonably quick and easy to assemble. When completed, it's a very attractive model that looks fast, fast, fast, even when sitting still! The two-piece wing slides onto an aluminum joiner tube, and each panel is fastened to the fuselage internally with nylon wing bolts. An airplane like this is not intended for beginners, and although there are a few glitches during assembly, I encountered nothing that would foil an experienced modeler. This same design is also available in a giant, 80.5" span for $400 (review in Feb 09 issue).

The kit was packaged well to prevent damage during shipping, using numerous custom-made internal boxes and cardboard separators. Particularly noteworthy in this kit is the beautiful fiberglass work, to include the cowl, wheel pants, pilot head, and turtledeck (that area of the fuselage behind the pilot's head). The pre-painted and pre-trimmed plastic and plywood cockpit is an easily removable piece granting handy access to the radio compartment and wing bolts.

This is one of those models that pictures somehow fail to show how good-looking the airplane really is. Whoever took the photos for the box-top and ads was a far better photographer than I, but even those fall short of pleasing the eye as does the completed model. I'm not a pylon racer by any means, but this is one pretty airplane!

Most of the assembly steps went very well, and I applaud those who prepared the Hangar 9 instructions for the greatly improved and more logical sequence in which the model comes together. Editing a previous model's instructions to reflect the needs of a new design is a proven time-saver, but it requires very careful editing. The Sundowner 50's instructions are good, but they fall short of earning one of those prizes from the very top shelf. Certain clues, however, point to the all too common problem wherein the factory delivers a production kit somewhat different than the prototype(s) on which the written instructions were based. You and I may get upset when the instructions don't match parts of the kit, but I doubt that our frustration level even *approaches* that felt by the distributor. Imagine yourself spending weeks carefully preparing an instructions book based on what's said to be a sample of the production kit. But then a thousand or so kits arrive that have numerous changes, all or most of which were unauthorized! In this particular case, some of those changes were improvements, but not all.

So, having expressed my sympathy and understanding for the problems instructions writers have to face, now it's time to point out the boo-boos.

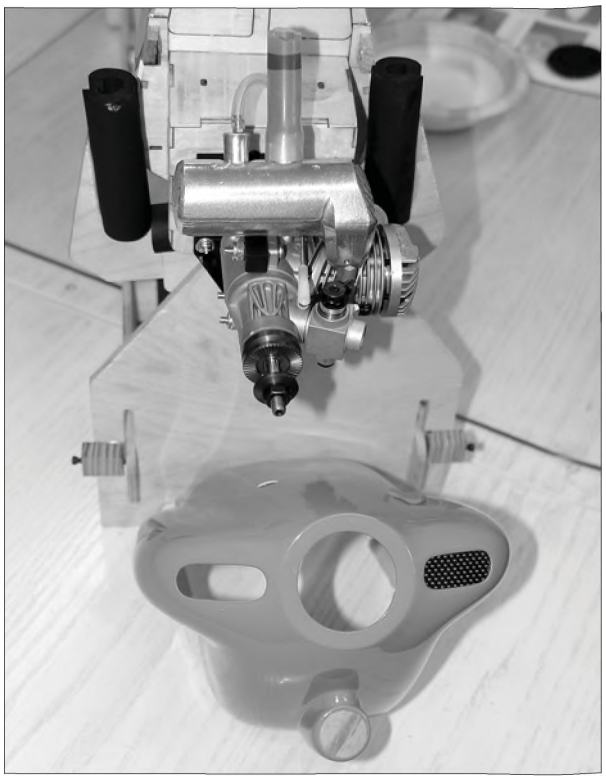
Page 3, Required Tools and Adhesives: To complete the ARF Sundowner 50, you will *not* need a soldering iron, solder, or Formula 560 Canopy Glue. But in addition to the rest of the list, you *will* need thick or medium CA, 30-min epoxy, silicone sealant (or something equivalent), and an 11/32" drill bit.

Page 8, step 2: The aileron servo covers have little, laser-etched boxes showing where the servo mounting blocks are to be glued. The size and shape of the boxes indicate placing the blocks on their sides to fill those boxes, but don't do that! Align the blocks on the edges of the boxes closest to the servo arm cutout, and then glue the blocks in place *upright*, so that the blocks stand tall. (See, I told you you'd need epoxy!) If glued on their long sides to fill the little boxes, the blocks won't be tall enough to accept two servo screws. (It's perfectly okay to *wonder* how I came to know this, but you're never, *ever* supposed to ask.)

If installing a 2C engine (the 4C engine page and step references are in parentheses here), see page 13 (18). Add to the Required Parts list the 12" clear plastic pushrod tube. Then see steps 1-2: After completing step 1, but *before* beginning step 2, turn to page 15 (20), step 8 (9). Mark the firewall to show where the sides and corners of the fuel tank will be. Then go back to page 13 (18), step 2. This way you won't have to remove the engine later to perform step 8 (9). Also, on page 15 (20), step 9 (10), use an 11/64" bit instead of the suggested 5/32" bit. The clear plastic pushrod tube is a hair too big for a 5/32" hole. Next, on page 15 (20) in step 10 (11), instead of leaving 1/16" of the pushrod tube protruding through the firewall, I suggest leaving about 1/4". It's hard to glue the tube to the firewall without getting glue inside the tube if only 1/16" protrudes. Shoot, you could leave 1/2" and still be okay.

The instructions for installing the fuel tank are... uh... let's see, how should I put this... Oh, I know... *they're wrong!* If installed with the fuel tank neck fitted through the hole in the firewall, the tank height will be too high and will prevent the cockpit from fitting properly. The tank *must* remain below the fuselage sides (ignore that higher recess in the former above the fuel tank). But when installed low and with the fuel tank neck *behind* the firewall, we're left with that big round hole in the firewall, not to mention all the open bolt holes not used! I chose the latter, with only the brass tubes and

fuel lines protruding through the big round hole. I fastened the tank in place with one of the long zip-ties, and added a scrap balsa retainer brace behind the tank. I later made a thin plywood cover to seal off the rest of the hole in the firewall, and filled the unused holes with high-temp silicone sealant.



On page 23, in step 5 of the Throttle Servo Installation, we're told to slide a little plywood guide onto the throttle pushrod tube, to be glued in place later. Guys, the throttle pushrod is plenty stiff enough as it is, and we don't need anything that will restrict its movement, so toss that little plywood guide into your scraps box.

Page 27, Wing & Cowling Installation: Apparently this kit was originally designed to have the buyer fit the cowl, tape it in place, drill the mounting holes, and fasten it with the described 1/2" screws. Normal fare for an ARF, right? Well, somewhere along the way, somebody installed a major upgrade after the instructions were published! Now the cowl already has three mounting holes, and the fuselage has matching blind nuts for 4-40 screws! (The screws are in the bag with the spinner, by the way.) So, go ahead with steps 1-5 (although I see no need to attach the wing at this point), skip step 6, and then do step 7 but ignore the wording about "the card stock". Now fasten the cowl to the fuselage with the three 1/2" 4-40 screws and flat washers. Then do step 8 if you want (but only temporarily), but skip steps 9-12. If you're installing a 4C engine, go to step 13 on page 30. If using a 2C engine, go to step 14 on page 31.

I couldn't do it. I just couldn't do it. Butcher that beautiful cowl, I mean. It's just sooooo pretty! Instead of hacking it up to clear the regular muffler, I dug out "The Big Box of Mufflers" to which I've been contributing for 30-some years, looking for a suitable in-cowl noise killer. Sure enough, I found a brand new Pitt's-style muffler produced by the late, great John Tatone (founder of J'Tec mufflers and accessories). It was originally a strap-on type, but there was room at the inlet to drill holes to match the Evolution .52's muffler screw pattern. It took another hour or so to mark the holes, drill 'em, and tap 'em, and then re-do the throttle pushrod to clear it, but not having to chop up the cowl made it worthwhile. The Pitts-style muffler has two-outlets, both of which are larger than the stock muffler's single outlet, so I made a hardwood plug for one outlet, saturated it with thin Zap, and glued it in place using high-temp silicone sealant. Then, since the muffler had no tap for muffler pressure, I drilled a 1/8" hole through the hardwood plug, and installed a pressure tap. During engine test runs, the one remaining outlet still proved to be too big. It was noisy and there was so little muffler pressure, turning the high speed needle all the way out just barely made the mixture rich enough to run reliably. So, I added a 2" silicone tubing extension to the muffler outlet, and jammed a 1/4" wheel collar into the tubing's outlet. Now the final outlet's diameter is about the same as the stock muffler's (0.256"). That made a world of difference on both scores. It was less noisy and there was enough fuel tank pressure to give a range of adjustment at the high speed needle.

The Sundowner cowl has three openings at the front. The one on the model's left side directs air to nothing, and since that air will compete with the cooling air for exit area, I blocked off the useless opening. I cut the blocking plate from a paper-thin sheet of Dragon Plate carbon fiber because the pattern has a better appearance than would a smooth, black plate. I left the lower opening alone since its air may help cool the muffler.

Finally, to allow fueling without removing the cowl, I added a T-fitting to the carburetor fuel line, and installed a red fuel dot on the low side of the right cowling cheek.

I found no error on page 37, step 3, I just want to remind you *not* to glue the landing gear fairing to the fuselage. Gluing it only to the landing gear plate will allow you to remove the gear for maintenance if necessary. I used a dab of Zap-A-Dap-A-Goo here because the landing gear plate will be flexing a bit during landings, so a brittle glue is not recommended.

On Page 40, in step 3, there's no real fault here, but do you really want your radio switch up under the wing where it's hard to see and even harder to reach? Do as you will, but I installed mine just above the trailing edge of the left wing. It was harder to install there, of course, but that's a one-time job. Reaching the switch to cut it On and Off will be done many times. (Yes, I'm an optimist.)

On page 42, in step 12 (although not actually numbered) the pilot support has an unexplained wedge-shaped base. Trial and error shows that the taller side of the wedge goes to the front.

Now that wasn't all that bad, was it? Well, okay... the fuel tank installation was a bit of a calamity, but tolerable if you have something from which to make a cover for that big round hole in the firewall, and a brace behind the tank to help keep it in place.

My completed Sundowner 50 weighs just 94 oz., which is 2 oz. less than the advertised minimum! The muffler I used weighs a little less than the regular Evolution .52 muffler, so maybe that's why. I was also able to balance the model at the recommended CG point by placing the foam-wrapped battery right behind the fuel tank. Don't you just love it when everything comes together so well?

With the control surfaces set to the suggested high and low rates, my Sundowner 50 is ready to fly, and I'm eager to see it do just that. I thought about calling Tony Coberly and asking him to meet me at the flying site, but the last time I called between midnight and dawn, he got downright nasty. Some people are moody when called at 2:00 a.m. No, I'll wait until the sun comes up. I'm considerate!

6:00 a.m.: *"Hello, you've reached the Coberly residence. We're not available right now, but if you'll leave your name and number after the beep, we'll get back to you as soon as possible. Unless this is you, Banks, in which case we moved and left no forwarding address. (Beep)"*

He's just teasing, I'm sure. So it was my turn.

"Hi, this is the Publisher's Clearing house, and we were calling to inform you that you'd won ten million dollars. But since no one's at home, we'll call someone else. Bye now, and have a nice day."

Flying the Hangar 9 Sundowner 50

Almost everyone at the flying site that day offered a similar comment, *"That sure is a good looking airplane."* And then, while we're prepping the model for its maiden flight, *"How fast is it?"* Well hang around and find out! We're going to make a trim flight first, but then we'll attach a Winged Shadow Systems "How Fast" to one wing and see how fast it is.

Now I have to preface the flying report with this: If you're looking at the Sundowner 50 as a good looking sport model, then we're okay. But if you're reading this wondering if it's an effective racer, then this report may be flawed. The Pitts-style muffler I used to preserve that beautiful cowl may have prevented the engine from making its maximum power. Although the test flights went well, we were left wondering if the engine might have performed better with the stock muffler. The Sundowner 50 flew well with the recommended Evolution 11x6 prop, hitting 82 mph. Then we tried an APC 9x10 prop. The engine did not like this prop, and it took considerable fine tuning, in fact, just to get the engine to take full throttle. It turned out that one click either way from "just right" would kill the engine! But surely that 10" pitch would dig in at speed and give us an impressive top speed reading, right? But it didn't. We got only 77 mph. Then we installed an APC 10x7. This one looked faster than anything before, and it was, but only a little (84 mph). But let me add this: not only does the "How Fast" add drag, the rudder had to be trimmed to compensate, adding even more drag. So we're estimating that all of those speed readings should be about 3 mph faster... maybe more.

But enough about top speed attempts. There may be a lot of pylon racers out there, but their ranks wouldn't fill a single platoon in a battalion of sport flyers. We who fly for the sheer fun of it, not wanting to compete with anyone, will be more interested in knowing how this very pretty model performs as just that... a great looking sport model.

Can you say "Sportsman Pattern"? The Sundowner 50's sleek lines and modestly sized control surfaces make for smooth and predictable flight characteristics. It's definitely faster than a flat-nose, thick-wing, .40-size Sweet Stik with a strong .52 2C engine on its nose, but it otherwise flies much the same. With its solid, neutral stability, it's a "go where you point it" flier that does just what you tell it to do, and it has a nice wide speed envelope that willingly provides plenty of fun at moderate speeds. Imagine a nice, fast, .40-size pattern plane that wasn't designed for wild, 3D maneuvers, and you're pretty much looking at the Sundowner 50. So if 85 mph sounds good to you, go for it. If it sounds too fast, reduce throttle! Either way, sport fliers will enjoy owning and flying the Sundowner 50. And did I mention how pretty it is?

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glbanks@knology.net
Tony Coberly
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FUN AEROBATICS

by Ed Moorman

MANEUVER OF THE MONTH
Knife Edge Flight

We normally see Knife Edge Flight with pattern and 3D planes, so many modelers think we need a special plane to do it. Not true. We can fly knife edge with many different planes. Some don't do it very well and will descend. Others will do it fairly well, holding a nose high level flight. The main problem encountered when doing knife edge with trainers and sport planes is the rudder coupling that invariably occurs on these types of planes. In a perfectly designed airplane, we could add rudder and only get yaw and nothing else. The problem is that nothing is perfect. Coupling means when we add rudder to hold the nose up in knife edge, our plane also rolls. Trainers and Sticks tend to roll out of knife edge back to wings level. The high wing planes will normally tend to pull toward the top of the plane. Low wing planes will tend to pull toward the landing gear. Later on we'll talk about fixing that.

DESCRIPTION

What does it mean when we say the plane is in "knife edge" flight? It means the plane is flying in about 90° of bank with the wing vertical. We can hold this position, or we can pause and pass through knife edge as we do in 4-point rolls. To perform knife edge we roll into a 90° bank and use the rudder to hold the nose up. With most sport planes, the nose is fairly high and it may take all the rudder we have. 3D planes will do a great knife edge, and perhaps even a knife edge loop. Most sport planes will do a fairly good knife edge. Trainers usually require a lot of elevator and aileron control in addition to the rudder, and generally won't hold level flight in knife edge. A high wing plane normally tends to roll out of knife edge.

In normal flight, the lift to hold the plane in the air comes from the wings. In knife edge, most of the lift to hold the plane up comes from the side of the fuselage. A little bit comes from the wings if they aren't exactly perpendicular to the ground. Just as we use the elevator to hold the plane in level flight, we use the rudder when we are in knife edge. We get the lift by holding the rudder to angle the fuselage upward to create lift. It stands to reason then that planes having a lot of fuselage side area will fly knife edge better.

KEYS TO COMPLETION

To do Knife Edge Flight we need enough side area to hold the plane up, enough rudder area and throw, and power in our rudder servo to hold the rudder deflected.

AIRPLANE SETUP

Without making any physical modifications to our plane, let's look at what can be done to help in knife edge. First, make sure the rudder pushrod isn't flexing. Turn on the plane and hold the rudder stick in full deflection. Take the rudder and see if it can be straightened out against the servo. You may notice the pushrod flexing when the servo is pushing the rudder. If this is the case, you'll need to put in some braces so the pushrod stays as straight as possible. This is one reason many people like pull-pull cables on the rudder, since we then get positive pull no matter which way we use the rudder. If you can't brace the rud-

RC REPORT MAGAZINE

TEACH YOURSELF AEROBATICS CARD

KNIFE EDGE

By Ed Moorman

KNIFE EDGE

What is knife-edge flight?
Flying in 90 degrees of bank with the wings vertical.

Where does the lift come from?
–Most of the lift comes from the fuselage.
–A small amount comes from the wings if they aren't exactly perpendicular to the ground.

What can help?
–A lot of side area especially toward the nose.
–A big rudder and a strong servo to hold it over.
–A canopy forward. You want area in front of the CG.

Things you can do to help knife edge:
Knife Edge Strakes. Two 3/16 x 1/4 stringers down the length of the fuselage at the top and bottom. These act like end plates on a wing and channel more air down the fuselage creating lift as opposed to letting is flow around the fuselage.
Bottom Extension. Sticks have a flat bottom from front to tail. Trace around the fuselage from the wing TE forward, then add 3/8-1/2 inch all the way around. Cut from 1/8 lite ply. Attach this to the fuselage bottom for a knife edge air dam.
Profile Canopy. Add a profile canopy to the forward fuselage.

DOING KNIFE EDGE FLIGHT

Always begin with the Standard Set Up:
1. FULL POWER 2. PARALLEL TO RUNWAY 3. 1 MISTAKE HIGH

–For your first tries, roll so the canopy is toward you. The controls are easier in this position.
–Do knife edge "by the numbers."
1. Raise the nose about 20 degrees and release the elevator.
2. Roll into 90 degrees of bank and neutralize the aileron.
3. Add top rudder. The rudder you use is OPPOSITE to the aileron direction with which you rolled in.
–Fly for a short distance then release the rudder and roll out.

der pushrod, notice which way it is in a pull mode. It will pull the rudder in one direction and push the other. Always start learning the knife edge using the pull direction.

I like a digital servo on the rudder, although they aren't absolutely necessary. We do, however, need a rudder servo that has a fair amount of holding power.

LEARNING KNIFE EDGE

Of course we're going to use our standard setup. For your first knife edge, you want the plane where you can see it fairly well, so put it right out in front.

STANDARD SET-UP

1. Full power
2. Parallel to the runway
3. One to two mistakes high.

A knife edge can be started and flown up or down wind.

THE FLAT TURN KNIFE EDGE TEST

The first thing we want to do is to find out what our plane does when the rudder is applied. It may just yaw, but then again, it may do something really weird like roll and then fall off into a flat spin.

Take the plane up a couple of mistakes high, fly parallel to the runway, and ease in half rudder or so and note what happens. We may have to force ourselves to not automatically correct with our right hand. I suggest trimming the plane for full power, hands off level flight, and then take your right hand completely off the aileron stick. Now ease in half rudder and note what happens. If the plane starts a nice, wing level flat turn, that's perfect. Trust me, however, your plane is not going to do this. It's going to roll and it's probably going to climb or dive. We just want to figure out what it does so we can fix or compensate for it. If the plane doesn't do much at half-rudder, then go ahead and use full rudder. If the plane has a small rudder like on a trainer or a Four Star, you'll need full rudder.

THE FLAT TURN WITH HIGH WING PLANES

After we determine what our plane does, try to compensate with the right stick. Let's say we're flying a high wing plane. These planes will normally roll in the direction of the rudder and climb slightly.

Take off, fly straight and level, and ease in the rudder. As the plane starts to roll, use a little opposite aileron to correct. Note that since the two controls are in opposite directions, the two control sticks will both move out or both will move inward.

With a high wing plane, we'll normally need a little down elevator, too. Now you have what I call a double handful of correction. We're doing a flat turn with the left stick, but we're compensating with both opposite aileron and down elevator with the right stick. It's much, much easier to learn how to do the compensation in a flat turn than in knife edge. In a flat turn, we can go all

-Beware a snap roll. If you release the rudder quickly, the plane's nose will have a tendency to drop, leaving you nose down. This tends to make people yank in some up elevator. Be cautious doing this especially if you are flying a plane with tapered wings like an Extra. They can snap roll.

Steering:
-Steering in knife edge is done with the elevator.
-You may need to band to hold altitude in the knife edge turn.
-Knife edge banks are the OPPOSITE DIRECTION!

Gaining Altitude:
-If your plane is a good knife edge flier, you just use more rudder to climb.
-If you are already using full rudder, use a knife edge turn. Bank away and use a little extra elevator. No one seems to notice you're climbing back up, just that you are staying in knife edge and making a turn.

Plane tries to roll out of knife edge:
Usual for high wing plane.
*Remove beveled upward wing tips.
*Add lower half end plates to reduce dihedral effect.

Plane tries to roll inverted in knife edge:
Usual for low wing plane with no dihedral.
*Try angled upward wing tips.

Pitch during knife edge:
Check your wing incidence. The wing and stab should be the same. If you can't adjust either the wing or the stab, try moving both ailerons up or down.
Check stab tilt. If your stab is tilted with respect to the wing, you will probably get pitching with rudder. Shim one side of the wing saddle to fix this.

Two Final Methods:
-Use computer radio mixing: Mix in aileron and/or elevator (slave) with rudder (master) to counter the roll or pitch in knife edge. Start with a small amount on the first try.
-Manually correct for roll and pitch. It takes some practice, but you can get it.

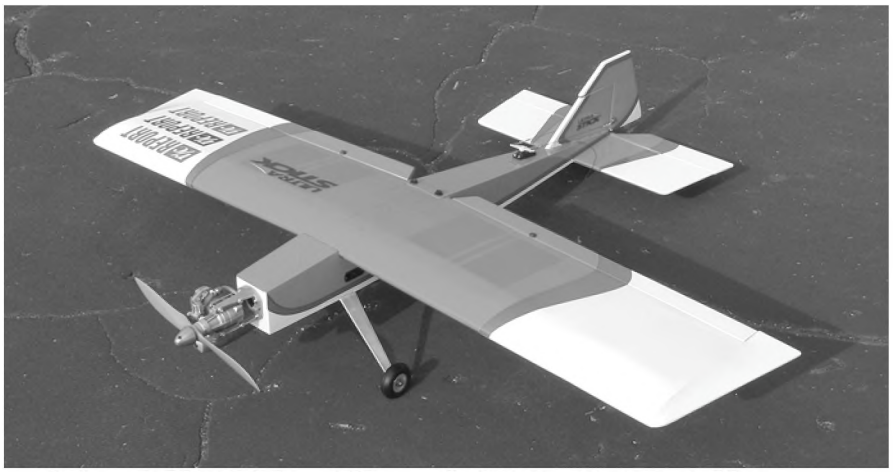

Photo 1: Ed's Ultra Stick 40 with anhedral to stop roll with rudder.

the way around a circle compared to the length of the field in knife edge so we have more time to practice holding the compensating aileron and elevator.

THE FLAT TURN WITH LOW WING PLANES

A low wing plane should be easier unless it has no dihedral. Without dihedral or sweep back, a low wing plane will usually roll opposite to the rudder. Nearly all low wing sport planes have dihedral, however, so there's usually nothing to worry about. Pitch is another story. Low wing planes normally tend to nose down with rudder input, and some do it rather sharply.

Practice to see if you can do a complete 360° turn using the rudder to make the turn, and using the ailerons to keep the wing level. You can really count this as another maneuver.

FIXING ROLL WITH RUDDER

There are three good ways to fix the roll coupling we get from using the rudder on a high wing plane. The first is to build-in anhedral. This has been covered in previous columns more than once. I've used it numerous times and it works very well. **Photo 1** shows my Ultra Stick 40 with anhedral. With 3° of anhedral on each wing, it will go around a knife edge loop with very little aileron correction.

The second way is to use downward end plates, which I've also covered before. These little gadgets act like they're inducing

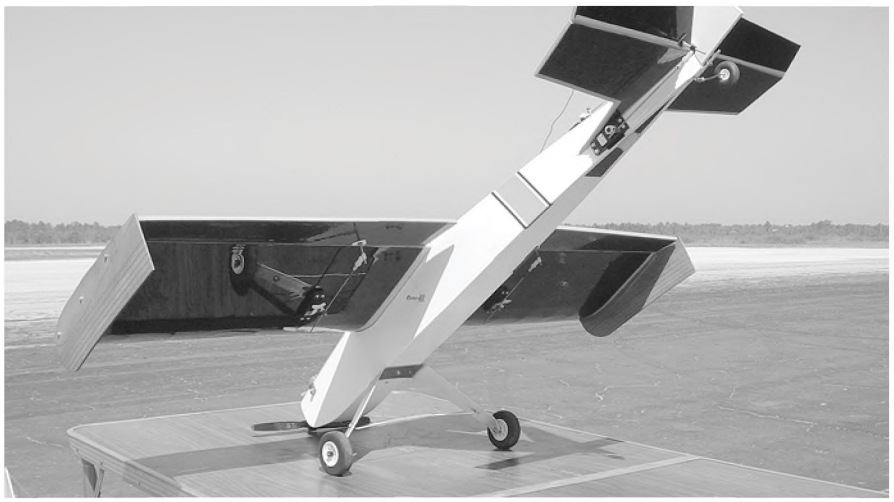

Photo 2: Ed's Little Stick with downward end plates to stop roll with rudder.

anhedral. **Photo 2** shows my Little Stick with downward end plates.

The third way to fix roll coupling is to mix it out. If you have a computer radio with mixing capabilities you may have one or mixes available to mix any two channels. If you aren't sure about mixing, you should learn to use them anyway, because you can do a lot of fun stuff with it. Find someone who's familiar with your type of radio, and ask him to give you a hand. Basically, you want to mix: rudder (master) to aileron (slave), and select a switch to turn it on and off.

Don't just guess at a percentage, or start with 5%, as is usually recommended. Turn on the plane and the transmitter, and move the sticks to where you held them to compensate manually. Note the position of the ailerons. Set your mix so when you have the same amount of rudder travel, the ailerons move the correct amount. Now remember the percent just in case you need to do this again.

FIXING PITCH WITH RUDDER

Fixing the up or down pitch change when we apply rudder is not so easy. We could change our CG, but we normally find a CG where the plane flies where we like it, and if we get pitch in knife edge... so be it. A harder way is to move the stab up or down. How much? Who knows? It's a cut and try thing. The best way to fix this problem is to mix it out by mixing in some down elevator with the rudder. This helps me get around a knife edge loop without too much correction.

Enough with fixing the plane and doing a flat turn, let's get to the real thing... Knife Edge Flight.

STANDARD SETUP

1. Full power
2. Parallel to the runway
3. One or two mistakes high.

Knife edge can be started flown in either direction, up or down wind.

1. Raise the nose about 20° and release the elevator.
2. Roll into 90° of bank and neutralize the aileron.
3. Add top rudder. The rudder we use is opposite to the aileron direction we used to do the 90° roll. You may also have to hold the aileron and/or the elevator to keep the wing vertical.

Use enough rudder to hold the nose up and maintain level flight. If using a good, fast airplane, this will be less than full rudder.

For your first tries, roll so the canopy is toward you. Being able to see the top of the plane gives you the best perspective of the plane. Fly for a short distance and then exit by releasing the rudder

Photo 3: James Welch's Uproar on floats is powered by an O.S. .46AX, and is waiting for spring to test on the lake.

Photo 4: **Daniel DeMaria with his dad, Frank's scratch built Hots. He is using an O.S. .46FX for power.**

Photo 5: Ed displays the Sky Raider Mach I test plane he used for testing his new Spectrum AR500 5-ch 2.4 GHz receiver.

and rolling back to level. If you release the rudder quickly, the plane's nose will have a tendency to drop, leaving the nose down. This has a tendency to make you yank in some up elevator. Be careful when doing this, especially if you're flying a plane with tapered wings like an Extra. They may snap roll unexpectedly. Yaw and up-elevator are the prime conditions for a snap roll, and more than a few people have been surprised by a knife edge exit snap. I've seen the snap in the opposite direction, when the pilot released the rudder stick, rolled out quickly, and grabbed some up-elevator. With a quick rudder release (like when we just turn loose of the stick) the nose slices back to center and momentum keeps it going for a yaw in the opposite direction. If the timing of the yaw swing to the other side matches up with the elevator input, we have snap roll conditions. This doesn't happen very often, but if you have a snappy plane, be aware and *ease* the rudder back to neutral.

Practice flying in both directions until you get the rudder movements down. Remember, it's raise the nose, release the elevator, roll in, and use opposite rudder.

Later you can try flying knife edge with the bottom of the plane toward you. I don't do this very often. The top of my planes always have a good color scheme, so that's the side I like to show off!

STEERING IN KNIFE EDGE

Steering in knife edge is done with the elevator. The rudder is holding altitude while the elevator steers the plane to the desired heading. If we lose altitude in knife edge turns, we'll need some bank to let the wing aid in providing lift. We bank in normal turns, right, so why not in a knife edge turn. In a knife edge turn, we bank away

from the direction we want to go. That's right, away from the turn.

Picture yourself in a right knife edge (you rolled right to enter). You're flying left to right with the top of the plane toward you. You want to make a turn away from you, a left turn. You bank right slightly and push some down elevator. You're actually in a steep bank, inverted turn, but using a lot of rudder. If you bank into the turn, the wings will be angled downward and you'll lose altitude really fast. If you bank away and use up-elevator to turn toward yourself, you'll be in a normal, upright, steeply banked turn. It takes a little getting used to, but if you have a good knife edge plane you'll soon be turning all over the place.

When you're learning to fly sustained knife edge, you'll often need to gain some altitude and the plane may not cooperate. Here's a trick you can use. (I have a lot of tricks in my mental file under "How to look like you know what you're doing when you're actually just hanging on, hoping not to embarrass yourself." Knife edge turns can be a big help in regaining lost altitude. You may not have enough rudder and speed to climb in knife edge, but in a turn, the wing and elevator help so it's easier to gain altitude. Bank away and use a little extra elevator. No one seems to notice you're climbing back up, just that you're staying in knife edge longer than they do, and making a turn.

Due to their weight, low speed, or lack of lifting surface, some planes won't maintain level flight in knife edge, and will begin a shallow descent. If your plane does this, look and see if the nose is staying at an upward angle, or if it's dropping. If the nose has dropped, you probably need more rudder area or a stronger rudder servo.

You also may find your plane holds knife edge better on one side than the other. This is usually due to a flexing rudder pushrod like I mentioned earlier. When the pushrod is being *pulled*, the rudder stays over and you get better knife edge. When the pushrod is *pushing*, aerodynamic force may flex the pushrod, causing you to get less rudder throw, less rudder authority, and less power with which to keep the nose up.

FEATURE OF THE MONTH

Well, I finally bought a 2.4GHz radio. I haven't been too concerned about frequency control since I fly mostly on 50 MHz HAM frequencies instead of the usual 72 MHz band. There are only three HAMS at my field, and we have 10 HAM channels, so we each usually have our own frequency.

Then a year or so ago, my flying buddy, Ugo Ferrari, and a few other guys started showing up with 2.4 GHz radios. Pretty soon I was hearing, *"Hey, Ed, when are you going 2.4?"* Then one of the other guys with a JR 9303 like mine showed up with a 2.4 GHz module in it. So, I finally caved in and bought a Spectrum 2.4 GHz module for my JR 9303 transmitter, along with a couple of receivers. I was going to get two 7-ch receivers, but Ugo talked me into trying a Spectrum AR500 5-ch. *"Ed,"* he said, *"it's tiny, it's cheap, and I*

Photo 6: Not an acro plane, but Flaps Laffert's latest, a scratch built 1924 Aeromarine EO. Note all the struts and the really small base of the fin. The EO was designed by Earl D. Osborne, who later started the EDO company, famous for their floats and who is still in business today.

know you have at least one plane that doesn't need seven channels."

Anyway, I ordered it. It *is* tiny, not much bigger than the size of a camera memory card. My question was, how well does it work? I laughingly told Ugo that since he talked me into buying the 5-ch receiver, I should use one of his planes to test it. He volunteered one right away, offering an old World Models Sky Raider Mach I trainer with which his son-in-law, Richard Deese, had learned to fly. This is a high wing, advanced trainer with a semi-symmetrical airfoil and a small amount of dihedral. The Mach I and its low wing brother, the Mach II, have been very popular in my club. Ugo said he would check everything out and bring it Saturday morning. All I needed was the receiver and transmitter.

Flaps and I arrived a little late that day, so Ugo had the Mach I ready and waiting. The plane had the requisite patches and repairs of a well-used trainer. The whole nose from the leading edge forward had been replaced, and the left wing had a large, dark blue patch. The engine was an old .46 that Ugo picked up at a swap meet for $20.

I removed the HAM frequency module from my JR 9303 transmitter, and replaced it with the 2.4 GHz module. Then I unscrewed the antenna and replaced it with a plastic stub. The 2.4 GHz antenna (with the cable to the module) then presses onto the plastic stub. Ugo and one of the other 2.4 GHz fliers helped me get the receiver installed and get it bound to the transmitter correctly. I'm not accustomed to the binding procedure, but it seems pretty easy.

I asked Ugo if the wings would rip off if I did some tight acro. He assured me that he had rebuilt it and it was guaranteed to hang together. He started the engine, and I throttled up to a high pitch scream. I quickly throttled back to idle and asked what prop was on it. He said it was a 10x6. No wonder the .46 was screaming.

I taxied out, lined up into the wind, held a little back stick, and added power. The Mach I was airborne about the time I got to half throttle. I turned downwind, leveled off, and gave the plane a couple clicks of trim. I flew way down south, turned back, and then flew about the same distance to the north of the field. The little receiver seemed to have adequate range, and I felt a good connection with the plane. After five minutes or so I landed. After shut down, I asked Ugo to change to an 11x6 prop since I thought the engine was revving way too much for sport flying in a trainer.

Ugo wasn't worried about the prop, though. He wanted to know how I liked the radio. *"Good range, right? I thought you were going out of sight. Feels good, doesn't it?"* I was beginning to think he was getting a commission on Spectrum radio sales. *"It was good, Ugo,"* I answered. *"But let me get a couple of more flights on it." "Okay,"* he said, *"but really wring it out this time."* You don't have to tell me more than once.

He changed the prop, refilled the tank, and got the engine going again. I took off and started wringing it out. Inside loops were good, and the elevator was plenty sensitive. Rolls were a little slow, but the ailerons are narrow on a trainer. Overall, I was pleasantly surprised at how well the Mach I was flying so far, so I decided to go for more.

Inverted flight takes a good bit of forward stick pressure. I tried an outside loop and was impressed, so I continued until I had done three. Then I climbed high and popped in down elevator for a downward square loop. How many trainers can do that?

The old .46 was pulling well, so I went through some eights. The Cuban-8's looked really good. My inside-outside eight was not too good, since the up and down sensitivity were different and the two loops came out different sizes on my first try. That can be fixed with a little practice or control adjustment. I did a couple of vertical eights and the engine pulled the Mach I through them nicely without staggering over the top.

Knife edge and point rolls are only so-so since there's a lot of rudder coupling, as you'd expect from a high wing plane with dihedral, and some pitch coupling. You can correct for the coupling, but you're holding a handful of stick. The plane will hold the knife edge position, but it does sink. The rudder is small, but the sinking knife edge might also be attributed to a weak rudder servo, a flexing pushrod, or a nose heavy condition.

You can string a lot of aileron rolls together, correcting with up and down elevator to keep the plane on line. Six or seven in a row are fairly easy. I was even able to do a rolling circle.

I never was able to get a snap or spin. Remember the airplane setups for these maneuvers? You need a good bit of elevator and rudder, and maybe the plane needs the CG moved back some.

Let's face it, the Mach I wasn't designed as an acro plane, but overall, I was very impressed with its ability. I was so into doing acro that I forgot about my main goal, checking out the new 5-ch, 2.4 GHz receiver! (It works great!)

BOTTOM LINE

The Spectrum AR500, 5-ch, 2.4 GHz receiver is a gem. I have no complaints whatsoever. It's inexpensive and it works really well with good range. Basically, I could tell no difference between it and one of my PCM receivers on a HAM frequency. Plus, there's no frequency pin to worry about.

I've been told that you feel more connected with 2.4 GHz, but I didn't notice this. I normally fly PCM with mostly digital servos. The Mach I has low-cost analog servos, yet it still felt like one of my PCM planes. Maybe the better feel on 2.4 GHz masked the slower response of the analog servos. I'll have to try the 7-ch receiver in a Stick with digital servos. I have a couple of planes that need only five channels, so I'm going to order another Spektrum AR500. The first one is going into a Sig Rascal on floats. Thanks, Ugo, for telling me about this little gem. *(Editor's Note: The Spektrum AR500 receiver is the one included with the DX5e radio used in two kit reviews in this issue, and the one in the Park Zone "Radian" was flown pretty darn far away, with no problems at all.)*

"R/C REPORT'S" FINAL ISSUE

Coincidentally, this is my 100th column, and apparently my last. Gordon, fellow columnists, and all you readers... Thanks! It's been great, and I'm going to miss you all! *-Ed Moorman*

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CLASSIFIEDS

CLASSIFIEDS ABBREVIATIONS

2C or 4C. . . two or four cycle
ARC. Almost Ready to Cover
ARF. . . Almost Ready to Fly
btry. . . . . battery
CL or UC. . . . . Control Line
cond. . . . . condition
DF. . . . . Ducted Fan
eng. . . . . engine
exc. . . . . excellent
FI. . . . . Front Intake
H or heli. . . . . helicopter
ign. . . . . ignition
NIB. . . . . New, In Box
ppd. . . . . postpaid
RC. . . . . need you ask?
RE. . . . . rear exhaust
RI. . . . . rear intake
RTF. . . . . Ready To Fly
Rx. . . . . receiver
SE. . . . . side exhaust
S&H. . . shipping & handling
Tx. . . . . transmitter
w/ or w/o. . . . with or without

CALENDAR

March

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

March 21, Lexington, NC: Triad Aeromodelers' Annual Swap Meet, 8:00a.m. til 1:00p.m. at the Davidson County Fairgrounds off Hwy BS 85 (behind Waffle House). Refreshments, raffle and door prizes. Admission: $5, wives and children free. Tables: $12 (interior), and $15 (wall). Visit www.triadaeromodelers.com or contact Tom Brittain at (336)764-2616

March 28, Huffman (NE Houston), TX: Jetero R/C Club's 13th Anniversary Celebration Fly-in, on club-owned 50 acre site w/100x600' grass runway (4 miles E. of Huffman, 1 mile N. of FM 1960 on FM 686). Planning to have one CL circle open, all R/C models welcome, AMA required (available on site thru CD Horrance Cain). No landing fee, free lunch. Accepting donations to the "Brother-IKE" re-build fund. Contact Horrace Cain after 03/01 for awards and possible Swap Shop area at cainhd@aol.com or (281)399-5627

March 29, Hermitage, PA: Skylarks of Sharon's Annual Swap Shop and Flea Market at the Hickory VFW (5550 E. State St.). Admission: $4 set up starts at 8:00a.m., only 55 full tables available ($10 per table, includes one admission). Concessions and 50/50 raffle. Send pre-registration (highly recommended) w/full payment to: Skylarks of Sharon, 350 Butterfly Ln, Hermitage, PA 16148. Visit www.skylarksofsharon.com or contact Phil Spillman (724)983-1677 (evenings and weekends) or... pspillman@roadrunner.com

COMMERCIAL CLASSIFIEDS

Join the NATIONAL ASSOCIATION OF SCALE AEROMODELERS! We encourage Scale Contests and Scale Fly Ins, and work to promote and advance all phases of scale aeromodeling. Whatever your interest, NASA has something for you. Benefits: NASA Membership Card, Patch, Decal, Scale Resource Guide, Bi-monthly Newsletter, and NASA Website. Send name, address, phone, AMA#, and $20 US, $30 Canada, or $35 Foreign, to Secretary/Treasurer Bonnie Rediske, 128 Darnley Dr., Moon Township, PA 15108. www.nasascale.org (12/09)

AIRCRAFT ENTHUSIASTS: Worlds largest collection of Aircraft "Photo-Studies" (8,200 subjects) and 3-view line drawings (39,000). Catalog on CD 2009/10, w/10 Scale articles, $5.00 ($8) Foreign. Bob's Aircraft Documentation, 3114 Yukon Ave., Costa Mesa, CA 92626 (714)979-8058 or... www.bobsairdoc.com (12/09)

FOR BEST DEALS ON PREMIUM KITS, visit www.stewartaircraft.com and click on model airplane kits. These are first rate models by a major manufacturer, many of them featured in this magazine. Free UPS (03/09)

$$$ for eng., buying and selling! All quantities considered, estates are my speciality. I charge 15%, you get 85%. Send $1.00 to get my list. Bob Boumstein, P.O. Box 390805, Omaha, NE 68139, (402)334-0122 (nights and weekends) (04/09)

NON-COMMERCIAL CLASSIFIEDS

FOR SALE

NIB Great Planes Giles 202 ARF, 73" span, $250. NIB Hangar 9 Cap 232 Matt Chapman white version, 73" span, $225. All + UPS. 1/4-scale Patty Wagstaff Extra (flown twice), pick-up only, $200. Harold Matthews, 614 Seashore Rd., Cape May, NJ 08204, (609) 884-7815 or crab614@comcast.net

Two Senior pattern legal models. Jim Kimbro's Deception, scratch-built from kit plans, Great Planes balsa fuselage, foam wing and stab, painted and covered w/Monokote, fixed gear tail dragger, $200. Panzer D-20 by Model Products (looks a lot like the Intruder), fiberglass and foam, in arc condition, fixed gear tail dragger, $100. Salient Designs Boxer 60 scratch-built from plans, retracts, YS .60 RE, Futaba 1024 PCM, 9-ch radio, painted and covered w/Monokote, needs a tuned pipe and it's ready to fly, $600. Models haven't been flown and are pick-up only. Perry Rose, 51 Plainfield Rd., Moosup, CT 06354 (860)564-5533 or prose0z@snet.net

NIB Zenoah G-38, $250. G-28 radial mount & spring starter, $50. NIB Coverite 21st Century iron #2700, $20. NIB Hobbico sealing iron, $10. New Hostetler plans for the PT-19 at 26% (114" span), $25. New 1911 Sommer Monoplane plans, 88' span, $25. Used Ziroli Stuka plans, 100" span, $15. All+ UPS. Milton Peacock, 2313 Da Lib Rd., Finksburg, MD 21048, (410)833-3122

Bring your items to sell or trade. Planes, motors, radios, accessories - anything hobby-related !

2009 Madison County R/C Swap Meet

Date: March 21, 2009
Time: 8:30am-1:30pm
Vendor Setup: 7:30am

Pineview Baptist Church
5614 Highway 53
Harvest, AL 35749
(North of Huntsville, AL)

Directions:
From I-65 take I-565 E - go 14 mi
Take the AL-255 N (Rideout Rd N) exit 14 - go 5.9 mi
Turn left at AL- HWY 53 - go about 4.0 mi
GPS
Latitude 34° 50' 21"N
Longitude 86° 42' 24"W

Door prizes, Raffle and Concessions!!
Indoor Facility; All Vendors Welcome!!
Admission $5.00, ages 7 and under FREE!!
Tables $7.00 at door, $5.00 in advance.
Raffle Tickets: $1 ea, 6 for $5, 13 for $10 or 30 for $20

Tables limited so call or email to reserve.

Event Director:
Ernie Duffey (256) 714-3176
eduffey@knology.net

http://narca.net/

WANTED

Piston and liner assemblies for Fox .40 ABC Q500 Special engs. Will buy damaged whole engines w/good piston and/or liner assemblies. David Keats, 2014 Atlas Dr., Troy, MI 48083, (313) 938-0282 or davekeats39@yahoo.com

Carl Goldberg Falcon 56 kit (1st version) for .09 to .19 eng. Old model magazines in good condition to fill my collection. If you have some old 1950-1980 issues you would like to sell, I can send you my "want" list. New, unused Noble slide switches for older radios. Don Patterson, 3508 Tothill Dr., Troy, MI 48084, (248)642-2917 or... rarebear4@comcast.net

NIB Great Planes Stuka. Harold Matthews, 614 Seashore Rd., Cap May, NJ 08204, (609)884-7815 or... crab614@comcast.net

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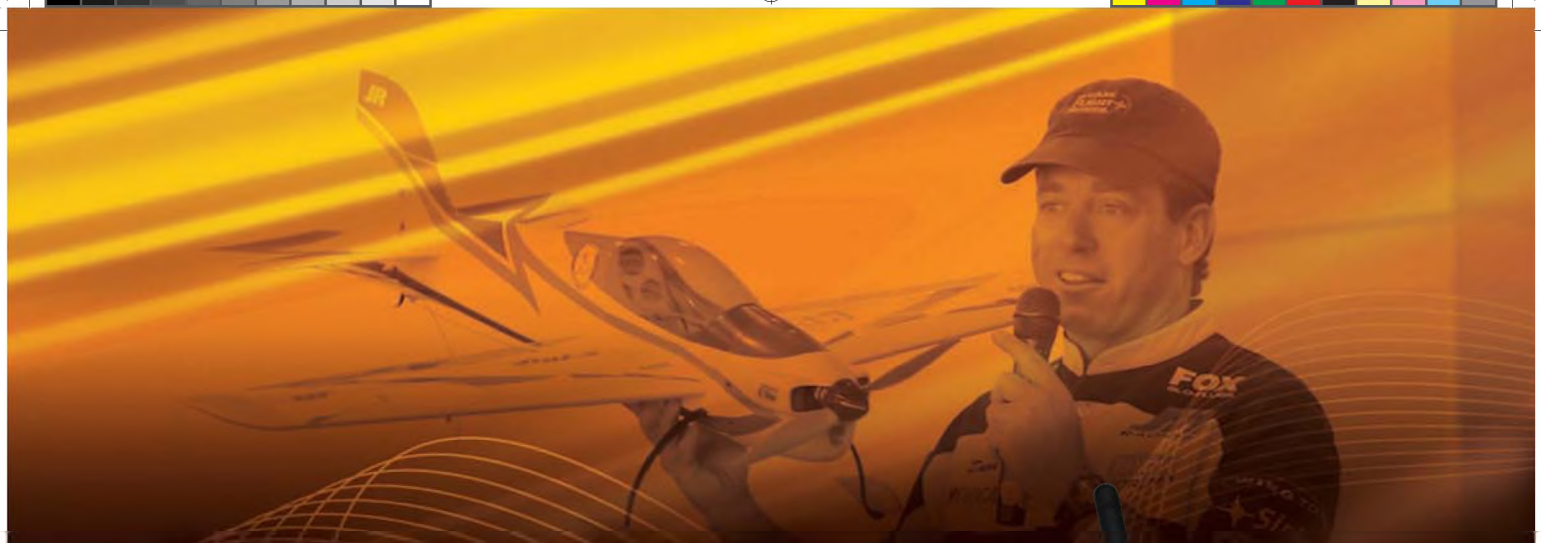

ACHIEVING A HIGHER EDUCATION

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.

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- 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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Wow!

Shown actual size!

Dimensions: 0.79 x 0.79 x 0.39 in (20 x 20 x 10 mm)
Weight: 10 g (0.3527 oz)

The GY520. The smallest, lightest heli gyro ever.

How does a heli gyro smaller than a postage stamp perform? If it's the GY520, the answer is "brilliantly." In tiny electrics and .90-size 3D aerobats. With analog servos as easily as digital servos. And on about one-tenth the current other gyros require.

There's no amp, no control box — just a tiny, ten gram square that's 6 grams lighter than any heading hold gyro around. It blends the superior tail-holding power of AVCS design with new sensors so sensitive that response is effectively instantaneous. And for fine-tuning, there are seven programmable features and three ways to set them.

The GY520 Gyro. The new state-of-the-art in gyro technology — and the newest member of the best-selling GY Gyro series.

For more information on the GY520 or the location of the Futaba dealer nearest you, please visit futaba-rc.com or call 1-800-682-8948 and mention code 85N.

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