r/c REPORT Online!

May Issue 274

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

Toledo Coverage!

Weak Signals 55th Annual RC Show!!!

E-flite Extra 260 3D 480
pg. 77

World Models Mentor
pg. 82

r/c REPORT ONLINE

MAY 2009

COLUMNS

From the Editor *by Gordon Banks*.....3
The BIG Picture *by Dick Pettit*.....9
Here's How... *by Walt Wilson*.....16
Radio Ramblings *by Tony Stillman*.....18
Bird On A Wire *by Terry Dunn*.....23
The Oily Hand *by Brian Winch*.....33
Sparky's Revolt *by Tony Coberly*.....46
The Webb Scale *by Gary Webb*.....49
Two Old Scale Guys *by Bill Hurt & Dick Watz*....58

FEATURES

Toledo 2009!.....62

PRODUCT TEST REPORTS

E-flite Extra 260 3D 280.....77
World Models T-34 Mentor.....82

World Models T-34 Mentor pg. 82

lines from the editor

MINIMIZING DEAD LEAD

I like to minimize the need to add "dead lead" (Yech! Boo!) when balancing a completed model, but with many kits this requires some planning, and it often involves a certain amount of inconvenience. My method of doing this is a pretty simple concept, but it means waiting until the model is very nearly completed before installing the fuselage radio gear and control setups. This is sometimes easy to do, and sometimes not, so it all depends on how badly you want to avoid adding the dreaded "dead lead". (Should I include a politically correct disclaimer and/or apology here to the lead businesses? I certainly mean no disrespect to people working in that industry. Goodness knows we need companies and people with jobs to continue paying their taxes so those of us without jobs can continue to enjoy comfortable lifestyles at their expense.)

We generally know pretty early, from a model's plans or instructions book, where the recommended CG point is to be. So we need that info and a means of balancing the model at the recommended point. If you're accustomed to checking the CG on your fingertips, so be it, but that's going to complicate this procedure, and it will take longer to complete the necessary steps. It's hard to adjust something while you're using both hands just to hold it. I prefer to use a balancing stand of some kind, even if it's just a pile of stuff under each wing stacked high enough to lift the model's wheels off the table by about 1/2". Then lay a short length of 1/4" square balsa or hardwood atop the pile for the actual balancing pivot point. However I do it, I want the model to be able to teeter back and forth on the balancer's pivot point as its CG is adjusted. If necessary I then stack stuff under the wheels to achieve that 1/2" gap I want.

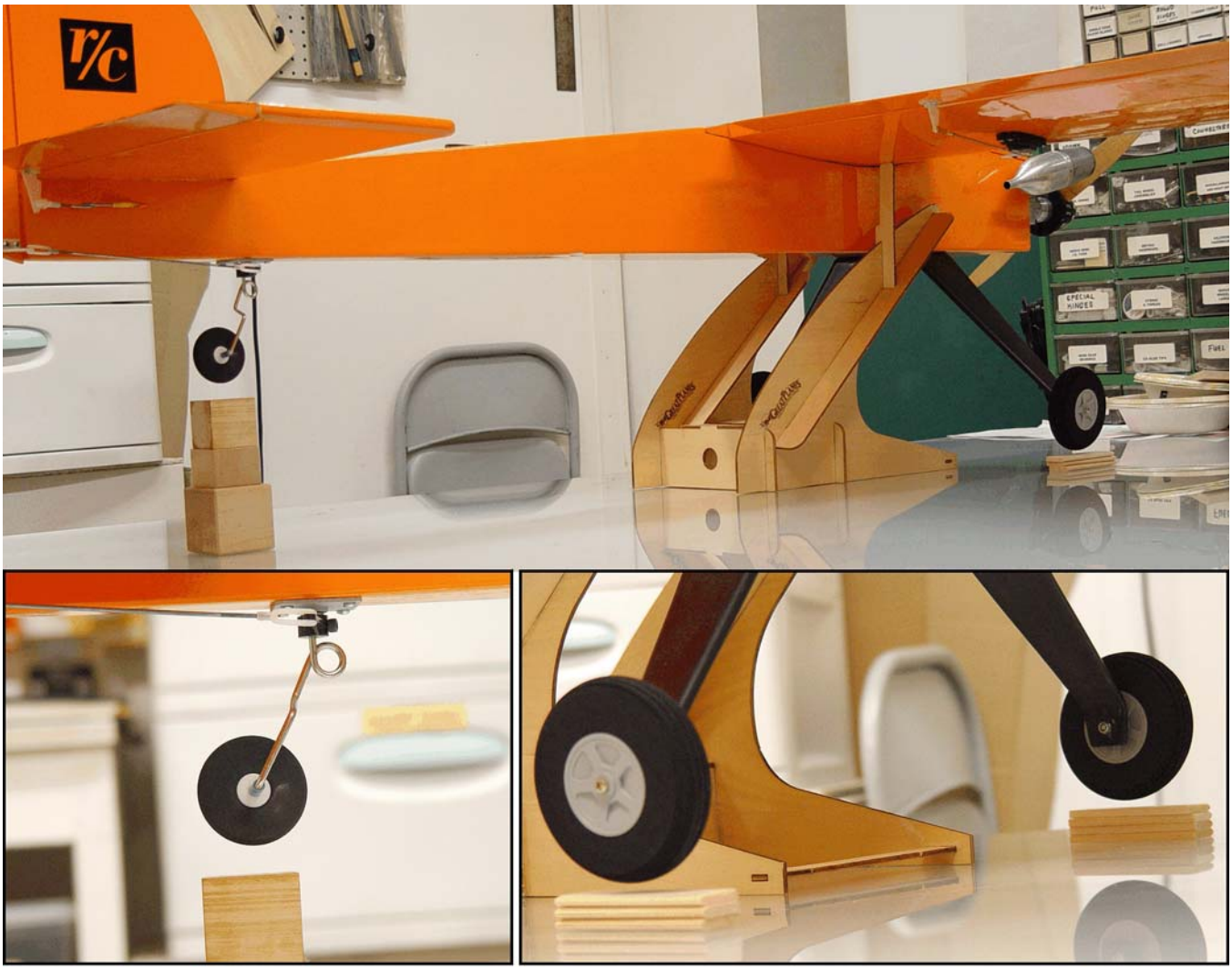

Photo 1: At top you can see my "Tiger 90 Stick" balanced on a balancing device. Now note the stacks of "stuff" (a technical term reserved for technical writers) under the wheels, leaving a gap that allows the model to rock back and forth at its CG, but it won't slide or fall off the balancing device. This way I don't have to use one hand just to keep the model in place.

This allows the model to teeter back and forth, but even when it's way out of balance, it won't fall or slide off the pivot point. I work alone most of the time, so I use this setup to allow me to keep my hands free to move weight around..

Now, when trying to move a model's present CG position to where we want it to be, we generally have little control over the *location* of the engine or motor, but we can often replace it with one that's heavier or lighter, to help achieve the desired result.

So, we really have little to work with other than the radio gear... the receiver, its battery, the power switch, servos, gyro, servo matching boxes, etc. And among all these, of course, only the receiver battery and servos have significant weight, so we have to keep that in mind. If we're building a kit (or assembling an ARF), we generally have little or no choice on where the aileron, flap, and/or retract servos go, but if we do have choices there, we keep that in mind as well.

Another consideration is pure and simple "convenience". We sometimes find it beneficial to move the fuselage radio gear well forward of where the instructions recommend installing it. Placing it far forward, however, may complicate our access to whatever else is installed far forward, such as when placing the receiver battery in the fuel tank compartment. How much inconvenience you're willing to accept to avoid adding "dead lead" is up to you.

Anyway, I assemble the model as completely as I can to include everything that has a fixed, no-option position. This includes things like the spinner, propeller, engine, muffler, cowl, fuel tank, wheels... pretty much everything *but* the fuselage radio gear.

Now, some models allow a little leeway when mounting the motor, often depending on a cowl. If a cowl is involved, can it be moved fore or aft a little to accommodate moving the motor for or aft? If I know there's a usable amount of leeway at the motor mount and cowl, and I have reason to suspect a tail-heavy model, I'll go ahead and move the motor and cowl as far forward as the design allows.

I eventually reach the point where the nearly complete model, but still with minimal radio gear, can sit upon my balancing device (see **Photo 1**).

At this point, most models will be nose heavy without the radio gear in the fuselage to bring the tail down. If so, I'll put all the fuselage radio gear in a small bag (or use something of equal weight). Then I'll place the bag on the fuselage, and move it fore and aft until the model balances at the desired CG (still assuming that it will balance).

If, on the other hand, the model is tail heavy without the radio gear, and the motor is as far forward as it can go, then I'll go ahead and install the radio gear as far forward as possible, keep the tail as light as I can, and just resign myself that nose weight will probably have to be used.

Once I see the point where the weight of the radio gear is needed, then I have to decide how much of it can actually be installed there. Remember, the radio gear can be spread out but still have the center of its mass at the desired point.

We also have the option of using a different battery to add or reduce weight. If I want a really high capacity battery but without the weight of relatively heavy NiCd or NiMH cells, I can use a lighter LiPo battery with a voltage regulator. For example, I have a few real powerhouse 6.0 volt batteries consisting of five, 2000 mah NiCd cells. These batteries weigh a whopping 10.2 oz. each, but I sometimes need the weight. On the other hand, I can get the same power from a 2-cell, 7.4 volt, 2100 mah LiPo battery that weighs only 3.7 oz. Add a 6.0 volt regulator that weighs only 0.5 oz., for a total of 4.2 oz. That saves a whopping 6 oz., and I'm getting a little more capacity (2000 vs 2100 mah) to boot! The downside, of course, is the cost of the battery and the need for a LiPo battery charger, but I already have that stuff, so...

Another frequent possibility is the throttle servo. Like most modelers, when assembling a .40 size or larger model, I tend to use more servo than I need for the throttle, simply because it's convenient. But when I need to lighten the radio gear "package" a little, I can almost always use a lighter throttle servo.

Anyway, by playing around with the weight and location of my fuselage radio gear, I can generally find a way to install it where I'll need little or no "dead lead" in the nose.

Although usually of relatively minor consideration, we shouldn't just totally ignore the weight of the controls such as pushrods, pull-pull cables, servo extensions, etc. Sometimes it only takes a little weight to fix a big problem.

Personally, I'll go to quite a bit of trouble, and put up with considerable inconvenience to prevent having to add anything more than 2% of the model's completed weight. If it's a big guy that weighs maybe 15 lbs. (240 oz.), for example, then adding 4 oz. (roughly 1.6% of the model's weight) is not such a big deal. But having to add even 1 oz. to a 32 oz. park flyer is something I'll try really hard to avoid. I don't know when or how I came up with that "2%" figure, but that's the limit I fight for.

In most cases, of course, kit reviewers don't do this when completing a kit for a Product Test Report. This is a pretty significant modification to the model's basic design, so the completed model would not be "as designed", or "as offered". In some cases, however, when a really significant amount of weight can be saved, we may choose to do our best at eliminating dead weight, and then

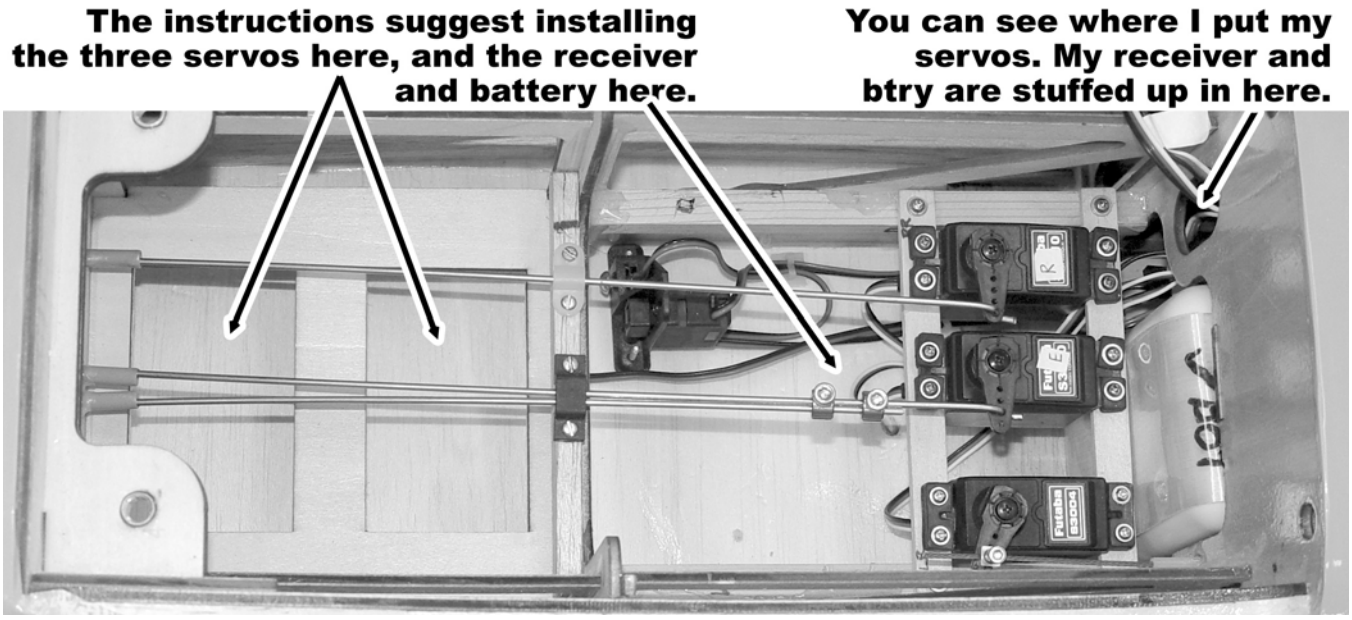

Photo 2 was borrowed from the Great Planes PT-17 review in *"R/C REPORT'S"* July 2005 issue. Moving the radio gear forward helped prevent adding so much nose weight. It still needed 7.8 oz.

explain how readers can do the same. Some people will argue that this is wrong, while others feel that it's totally appropriate. If you can tell your readers how to make the completed model better, should you or not?

Once such example was the Great Planes PT-17 biplane that I reviewed in the July 2005 issue (#228). The instructions recommend installing the radio gear toward the rear of the radio compartment, and later adding whatever nose weight is necessary for balancing. They even include a "weight box" in the kit for this purpose (see **Photo 2** borrowed from that review). When I noticed how simple it would be to move all the radio gear forward, I did so, and I'm glad I did! Great Planes recommends a flying weight as high as 15.5 lbs. for that model, but mine came in at only 13.75 lbs., and that's with a powerful O.S. FS-1.20 in the nose, a big battery, and 7.8 oz. of lead in the nose. At 15 lbs. the wing loading would have been 23.15 oz./sq.ft. At 13.75 lbs., however, my model's wing loading was only 21.2 oz./sq.ft. Was it worth all the trouble? I sure think it was!

A more recent example in which I wish I *had* moved the

Photo 3 shows the radio compartment in my Goldberg Tiger 120, with the servos installed where the instructions suggested. Had I moved all those servos far to the front, I could have prevented the need for so much dead lead in the nose. Warning: Photo 4 is ugly and unsuitable for weak stomachs.

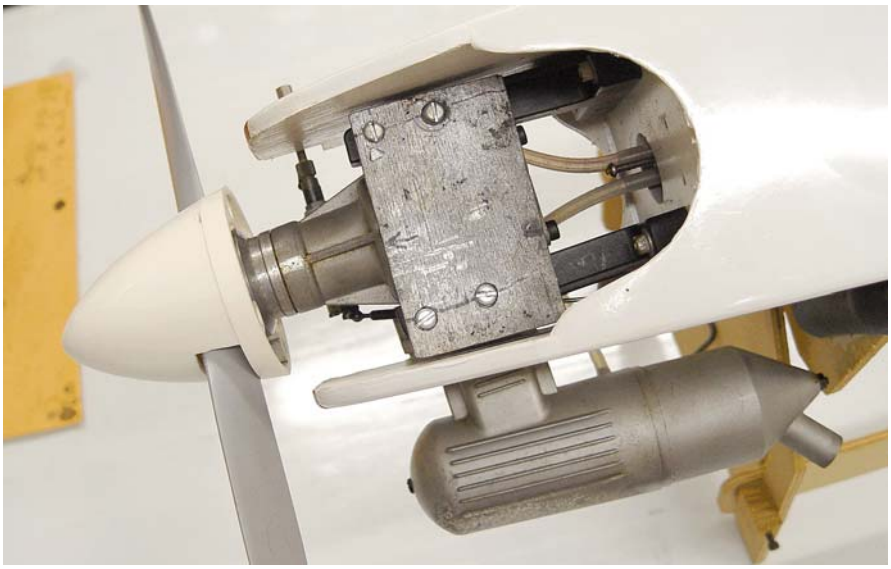

Photo 4 is hard to look at without turning away in disgust, isn't it? That 17 oz. hunk of used-to-be-wheel-weights makes up about 9% of the completed model's total weight, and adds nearly 2 oz. to the wing loading. (Should I have censored such a graphic photo?)

radio gear forward, was the Carl Goldberg Models "Tiger 120" with the optional tail wheel kit, reviewed in the Feb 2009 issue (the printed and online versions). Here too the instructions recommend placing the radio gear pretty far back in the radio compartment. I did so, and look what I later had to do to get the model to balance correctly! (see **Photos 3 & 4**).

First I replaced the engine. Instead of using the brand new, 27 oz. O.S. .91AX engine and muffler combo I had planned, I bolted in my 36 oz. O.S. 1.08FSR and muffler. Then, instead of using a "normal" 5.2 oz. 1000 mah receiver battery, I used one of those massive 10.2 oz. 5-cell 2000 mah batteries described earlier. And I shoved it as far forward in the fuselage as I could get it, too. And after adding all that extra weight in the nose, I still had to add dead lead under the engine. How much? Did it exceed my "no more than 2%" goal? I had to use an incredible and totally inexcusable 17 oz.! The completed, ready-to-fly model weighs 192 oz., so about 9% of the model's total weight is dead lead! Believe it or not!

I still have the Tiger 120, so I could go back in and move the radio gear further forward. Right now all but the battery is behind the CG (shown by the black marks on each side of the fuselage), and I'm pretty sure I could get every bit of it ahead of the CG. The trouble is, doing it now means modifying three pushrods and the rudder's pull-pull cables, and re-forming the 17 oz. nose weight. That's a lot of work for a model that, I must admit, flies fine just as it is. Still, it sure would be nice to see how it performs a full pound lighter. Maybe some day.

I told you in the March Online issue about my newly completed "Tiger 90 Stick", built from an old ModelTech "Joss Stick" kit. Well, it too suggested installing the fuselage radio gear toward the rear of the radio compartment. But since this model was not being completed for a Product Test Report, I was free to make whatever changes I wanted. And sure enough, one of those changes was to install the fuselage radio gear toward the front of the radio compartment (see **Photo 5**). I simply installed new servo rails, made up new pushrods from Sullivan Products Ny-Rods, and installed all four servos side by side for a nice, neat package (from top to bottom the servos are throttle, left elevator half, right elevator half, and rudder). The battery is mounted on the left side (using 1/4" thick sticky-back foam rubber) to help counter the weight of the engine's right-side muffler. The area behind the servos is now filled with air... but I use only special, light-weight air from Washington D.C. where "hot air" is in great abundance!

Doing this to the Tiger 90 Stick had no downside, and I think the Tiger 120 would have worked out just as well. In the Great Planes PT-17, however, there was a definite downside. To access the receiver or its battery where I put them, the servos and fuel tank first have to be removed. Is such inconvenience worth the weight savings? I decided that it was, since the benefits of the weight savings would be experienced

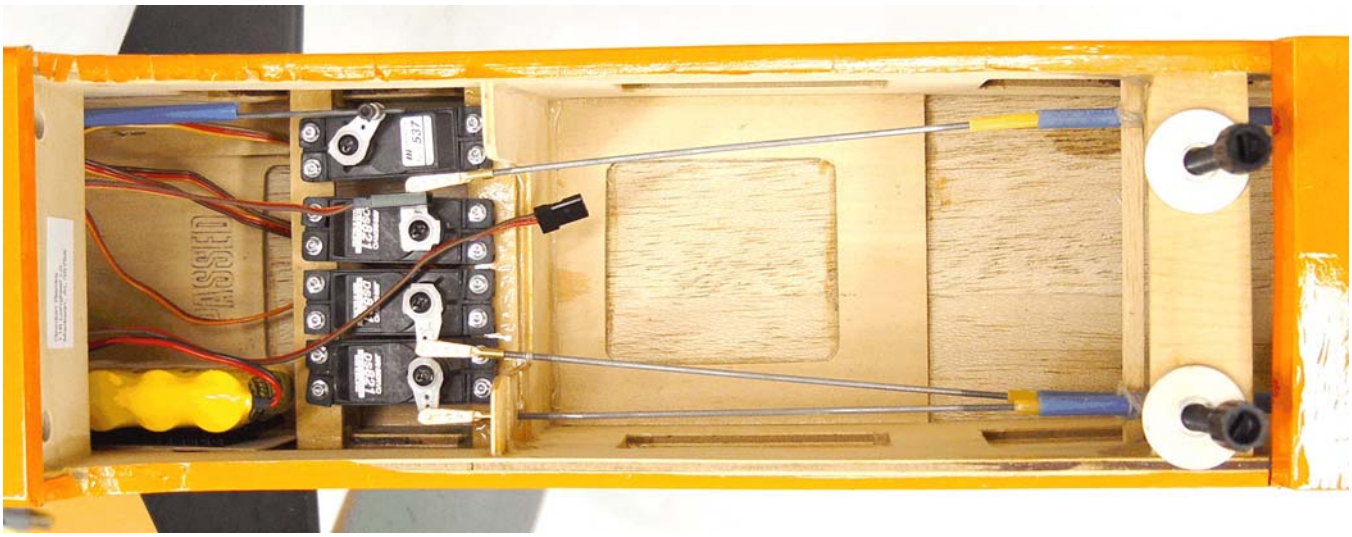

Photo 5 shows the radio compartment in my Tiger 90 Stick. Ignoring the instructions' suggestion on where to install the servos, my balancing test showed the need for more weight up front, so I moved all four servos forward, and ultimately needed no nose weight at all.

a lot more often than would be the inconvenience of accessing those two components. Your mileage may vary.

Lesson Learned: In the great majority of cases, I think it's appropriate and proper to at least start off with the model designer's recommended CG point. But we don't have to install weighty items right where the plans or instructions suggest. It's your model, so install the radio gear and control linkage where you want them.

NEW WORDS

According to an article in a major newspaper, there are five times as many words in the English language today as there were in William Shakespear's day. Many new words come from new technology. Mr. Shakespeare (since we're both writers, I get to call him "Bill") didn't have words like radio, television, airplane, internet, or Silly Putty, or phrases like *"I ain't got it!"*, or *"Landing, left to... Oops, never mind."* But technology is not the only source of new words. Some are born simply because they somehow appear and gradually become popular.

Here are a few new words that are currently growing in national popularity (and which are playing havoc with my spell checker):

Cashtration; the act of buying everything needed for a brand new giant scale model, which usually leaves the buyer financially impotent for an indefinite period of time.

Arachnoleptic Fit; that frantic dance performed right after you accidentally walk through a spider web while searching in the woods for your new model.

Intaxication; the euphoria of getting a tax refund, which lasts only until you remember that it was your money in the first place.

Reintarnation; coming back to life as a hillbilly.

Decafalon; the grueling challenge of getting through a whole day at a fly-in while consuming only food that's good for you.

Caterpallor; the color of your face right after finding half a worm in the apple you're eating during a decafalon.

Ignoranus; a person who is both stupid and an ass.

Bozone Layer; that invisible layer of substance surrounding an ignoranus that shields him from any and all intelligence.

I hear there's a proposal in Washington D.C. now, trying to get politicians to wear uniforms like NASCAR drivers wear. That way, you see, we could tell at a glance who their corporate sponsors are.

-Gordon L Banks
glbanks@knology.net

THE BIG PICTURE

by Dick Pettit

Well, here we are with the second issue of RC REPORT ONLINE, and I hope everyone had an enjoyable building season, because this year's flying season is here! Oh yeah... I tend to use "building season" now instead of that ugly word, "winter", because down heah in Nawth Calina we gave winter up years ago. As I've said many times, I wasn't born in the South, but by golly I got here quick as I could!

For those of you reading my column for the first time, let me explain its purpose as I see it. There are many, many R/C modelers out there who have been flying .40 and .60 size sport and scale models for years, but who are now interested in trying something larger. Every modeler knows that there are some basic differences between the giants and smaller models, but not every R/C'er is exactly sure just what those differences are.

(Editor's Note: Not everyone knows (or perhaps "agrees" is the better word) just what a "giant" model really is. In most cases we at RCRO tend to observe the IMAA (International Miniature Aircraft Assoc.) definition that says giant models (sometimes referred to as "giant scale", even when the model isn't actually "scale" (see category 4)) fall into one of the following four categories:

1. Monoplanes, propeller driven airplanes having only one wing, must have a wing span of 80" or more.

2. Biplanes and Tri-planes, propeller driven airplanes having two or more wings with a wing span of 60" or more.

3. Jets must have a combined overall length and wing span of 144" or more.

4. Scale models, those modeled after a particular full-scale aircraft, that are smaller than the sizes listed in categories 1-3 are still legal "giants" if they are true 1/4 scale or larger. In other words, a smaller scale model is still considered a giant if its size is 25% or more of the full-size aircraft's size.)

Now, I'm not talking about those mega-buck specials that are flown only at special events. I try to provide useful information concerning what needs to be upgraded when it comes to engines, radio equipment, building materials and techniques, and any other considerations that should be taken into account when moving up to giant models. Sure, I sometimes off the well beaten path when something special grabs my attention, but I usually try to get back on track as quickly as possible. Also, if you have any related questions, ideas, or suggestions for topics to address in this column, please feel free to contact me or Tony with your thoughts.

This month I'll show you a local flier's 3D model, I'll de-

Photo 1: Jim Meyer, of Raleigh, NC, with his Great Planes Extra 330S.

scribe how I reinforce wooden joints while adding little or no extra weight, I'll show you my own latest project, and I'll try to describe my thoughts when flying a model for the first time.

So now let's take a closer look at this month's "The BIG Picture".

EXTRA SPECIAL EXTRA

I recently received an email from a local flier who has several nice aerobatic models, including the one seen above in **Photo 1**. This is Jim Meyer, of Raleigh, NC, and his Great Planes Extra 330S. Jim is a member of two local clubs, RDRC (Raleigh-Durham Radio Control) and JCAC (Johnston County Aeromodeling Club) in Smithfield, NC.

Jim powers his Extra with a Fuji 64cc gas engine, while controlling the 17.2 lb. model with a Spektrum DX7 radio.

Jim enjoys the way the Extra flies, especially with the higher power level available from the big Fuji engine. I'm sure he'll use all that power wisely.

WHEN IN DOUBT, PEG IT!

Over the years I've been reinforcing wood to wood joints using the popular "peg it" technique. This method is popular because it adds practically no additional weight, yet it makes suitable joints much stronger. I've seen some reinforcement techniques that add so much weight, they practically defeat the purpose of the reinforcement itself! Gobs of heavy epoxy smeared on a joint may add a little extra strength, but it also adds a lot of extra weight, and the strength gains

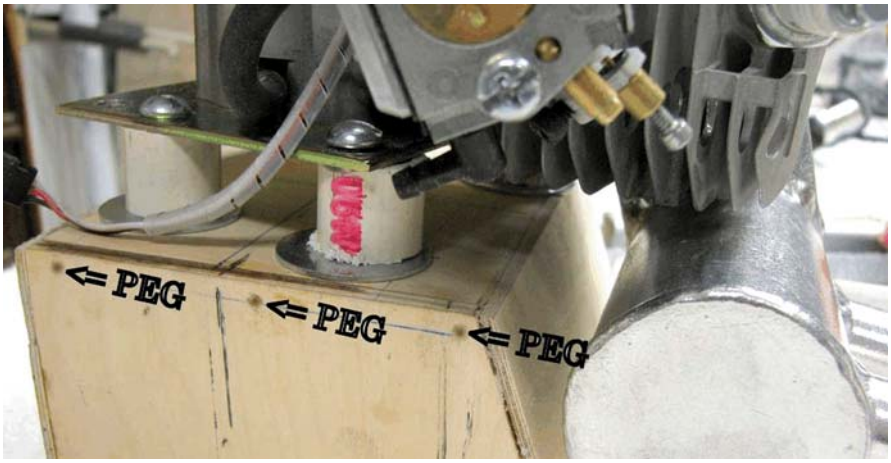

Photo 2: Wooden dowels pegging the engine box sides together.

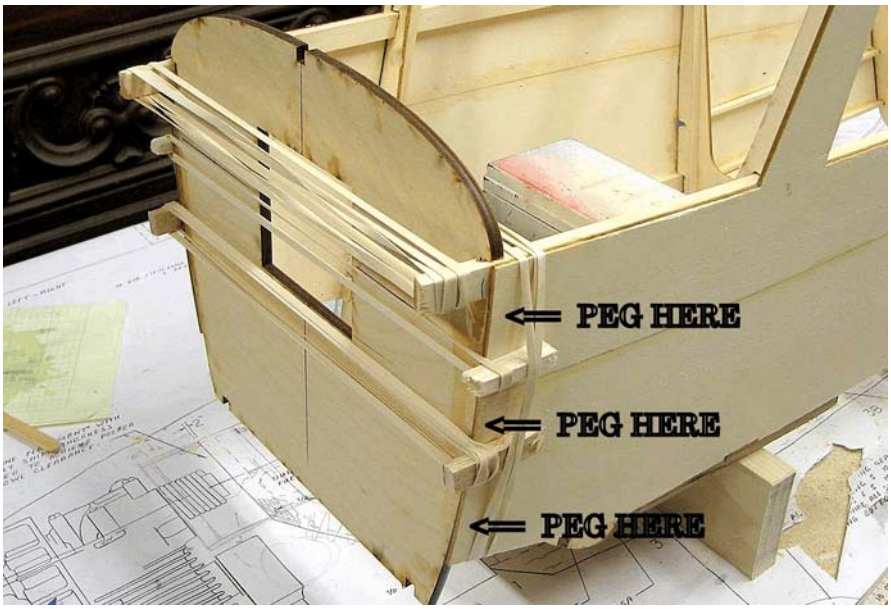

Photo 3: Typical peg locations on a fuselage-to-firewall joint.

are far less than some better alternatives. Wooden triangle stock added to a corner joint works well when the joint is large enough, and fiberglass cloth epoxied in place works well when the cloth makes perfect contact with the underlying structure. These are good ways to add strength, but they're sometimes messy and they always add weight.

So, when the joint is suitable, I like "pegging" joints for the added strength with minimal weight gain. The pegs themselves are simply little wooden or bamboo dowels, usually 1/8" in diameter, inserted into holes drilled through the joint. I use yellow carpenter's glue to hold the pegs in place, as seen in **Photo 2** in a plywood engine box. This phot shows what the pegs look like after the glue dries and the excess dowel is sanded away. The resulting joint is much stronger than just a standard butt joint, since it ties the two pieces together with material deeper than just the surface.

How many pegs do I use? I try to space them about 1" to 1-1/2 apart, and I use a peg

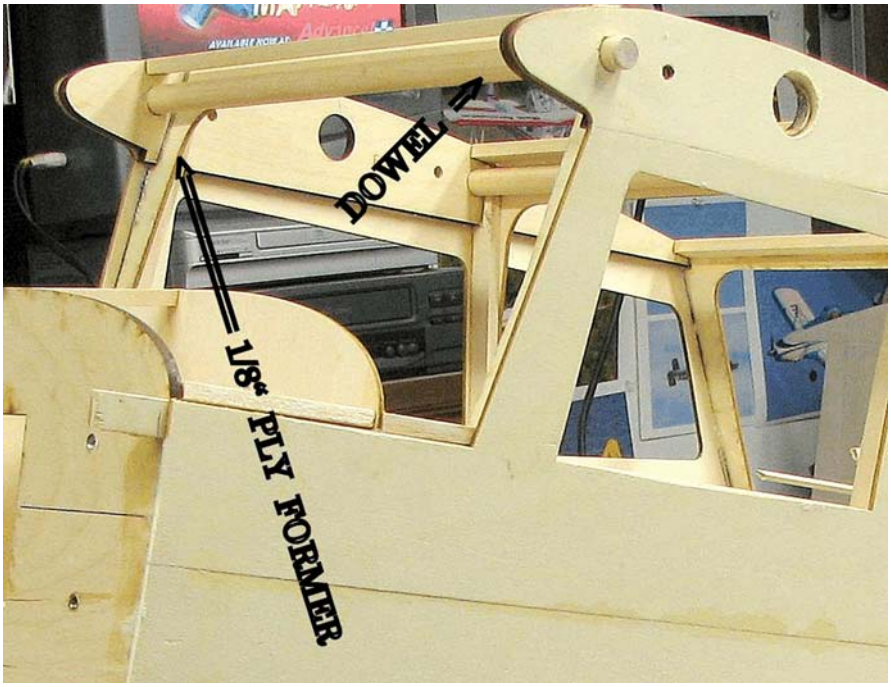

Photo 4: Fuselage structure prior to pegging the wing dowel.

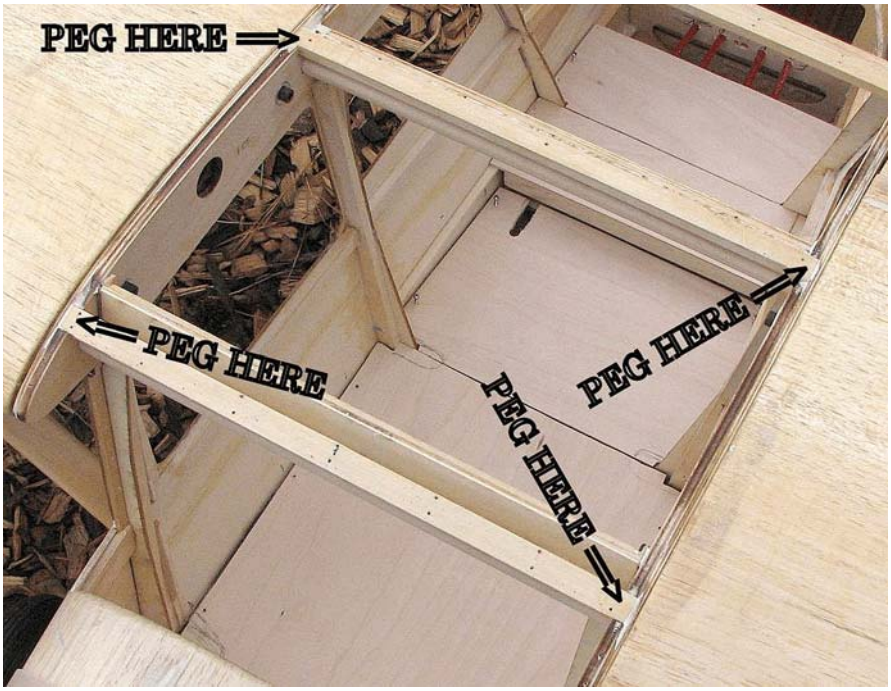

Photo 5: Location of music wire pegs to reinforce the critical wing-to-fuselage joint.

length at least twice the thickness of the wood at the joint, often going a full 1" deep into something like a 3/8" or 1/2" thick plywood firewall. **Photo 3**, in fact, shows the typical peg locations I use where fuselage sides attach to a 3/8" thick plywood firewall.

I recently had the less than enjoyable experience of a joint failure during a less than perfect landing (we sometimes refer to this as a "Gordon"). The plane tipped over on its back and one of the wing tips caught in the grass, pulling a joint apart. **Photo 4** shows the original structure in that area, where plywood formers were the only things keeping the fuselage sides together. There were some 1/2" dowels used to locate the wing root ribs, but they were not glued to the structure well. Under high stress, the fuselage sides can be pulled apart quite easily.

Photo 5 shows where I drilled holes vertically through the fuselage sides, through the existing dowels, and back into the root rib. Here I drilled 1/16" holes, and used music wire pegs epoxied in place. These should hold everything together!

Whether or not you decide to use pegs in your next project is up to you. But take it from me, pegged joints will take a lot of stress before they fail, so give it a try.

IT AIN'T NUTHIN' BUT A BIRD DOG

During the same time period that *"R/C REPORT"* Magazine was forced to close, and just as Tony's online effort was born, I was working on a new giant scale project. **Photo 6** shows my 25% scale L-19 Bird Dog during its initial test flights. This model was born from a set of Roy Vaillencourt plans and accessories, a laser-cut kit from Precision Cut Kits, and a detailed interior kit from

Photo 6: My latest project, a 25% scale Cessna L-190 Bird Dog.

Dynamic Balsa. The 108" span model weighs 28 lbs. finished with fiberglass cloth sealed using water-based polyurethane, primered, and painted with Behr brand latex paint. Control is via a Spektrum DX7 radio system using Spektrum DS821 digital servos, and a set of 2300 mah A123 lithium batteries. I'll save my comments on the batteries for a future column after I've tabulated data on their capacity, longevity, and reliability. I will say now, however, that they powered the plane perfectly without the need for a voltage regulator, which is usually required when using regular Lipo cells.

It took me about three months of spare time fun to convert all the parts and pieces into a flying model, and except for a little warp in one wing panel, the plane flies very nicely. The functional flaps really smooth out the landing approaches, and the reliable Zenoah G-45 engine swinging an APC 22x8 prop provides more than enough power, even at half throttle.

Since *"R/C REPORT"* Magazine was closing at the time, and I was not yet aware

of Tony's plans for *"RC REPORT ONLINE"*, I offered my review of this project to *"High Flight"* (the IMAA magazine), and they accepted it for publication. Still, I'll be more than happy to provide more information to anyone interested in this model, if you will send me an email with your questions.

RANDOM THOUGHTS

I don't know about you, but I seem to get an uneasy feeling almost every time I drive to a flying field for a new model's maiden test flight session. Let me try to describe these feelings, and maybe you can relate to one or more. *(Editor's Note: Hmm, that's odd. I never have any "uneasy" feelings. In fact, I'm usually too numb with sheer terror to feel anything!)*

These feelings I'm talking about get more and more powerful the closer I get to the flying site. I start thinking about all the things I had to do to create a flying model from numerous boxes of modeling goodies. Now we're arriving at the flying site where I'm about to verify that everything I've done was correctly completed. And all with the intention of cheating the laws of gravity of their ever-present desire to keep everything on the ground, and to punish those who try to break those laws. Naturally, I wouldn't be at the flying site now if I didn't believe I had done everything correctly, so once the desired ground photos are taken, I fill the fuel tank, start the engine, and when everything seems ready, I'll carry or taxi it out onto the runway. There are usually many other pairs of eyes watching me and the model. Most, if not all, have their emotional fingers crossed, joining me in hopes of success. No one likes to see a friend destroy a model airplane. I mean, if there *is* a crash, everyone hopes to see it, of course, as this usually provides a fine foundation for good-natured ribbing and jokes for years to come. But no true modeler actually *wants* a crash to occur. So they're all there, just waiting to see what happens, one way or another.

Once the wheels leave the ground, I try to remain calm and ignore the knocking-knees syndrome, as I adjust the trims to keep the plane in the air and heading in a direction of my choice instead of one picked out by the airplane itself. Pilots are supposed to control and direct their airplanes, not just make corrections.

Once the airplane is trimmed for straight and level flight at the throttle setting I choose, I fly a few easy circuits around the field to become more familiar with its flight characteristics. If anything feels less than "right', I'll immediately bring it back in for inspection and adjustments. But when everything seems fine, I'll choose certain flight maneuvers to attempt, such as low and slow fly-bys for a friend with a camera, stall-tests, and maybe some basic maneuvers to include "practice" landing approaches about 100' over the runway. As the flight progresses further, I usually calm down a little while trying to keep a cool head as I watch for anything unexpected or out of the ordinary. These include unexplainable sudden movements of the airplane, unexpected changes in power, things falling off in flight (never a good sign), or just anything that evokes that dreaded and infamous *"Oh (expletive deleted)!"* response.

Then, just about the time I get comfortable flying the new model, that uneasy feeling begins creeping back when it's time for that all-important first landing. Most of the time the engine is still turning the prop, but sometimes the model is powered by gravity alone, so all landing approaches must be judged accordingly. Now the level of hidden inner panic peaks as the model approaches the intended landing area for its first touch-down. Doubts begin to blur rational thinking. *"Do I have enough airspeed? Is it going too fast? Will I make it back to the runway? Should I go around and try for a better approach? Is there a possible conflict with another flying model? Is the runway clear? Does the model still have three wheels? Did I really install the landing gear blocks correctly? Did I remember to pay the utility bill?"* All these questions

and more flash through my mind while trying to fly the model down onto the runway for a soft landing, bringing the new model's maiden flight to a successful conclusion. Then, *finally*, the uneasy feelings are washed away by more welcome and comfortable emotions, like pride, success, and renewed confidence.

Soon it's time for subsequent flights, with tests yet to perform, and characteristics still to discover, but these are flown with fewer qualms and far more confidence. After all, the model has now been proven flight worthy, and I already know what to expect from the engine and control surfaces. I usually learn and remember very little from the first flight, other than that it *was* a successful flight, and that I still have a model to fly again. Naturally, then, most of my evaluations and review comments come from the follow-up flights, when I have some reserve brain functions to make appropriate mental notes.

Not every maiden flight session takes place exactly as described above, but most problems can be traced back to the builder or the pilot, and... well, that's just the way it goes. As builders and pilots we always try to do our best to avoid errors and problems, but we're only human, so every now and then something slips past us and allows gravity to punish us for our sins. We do what we can, and then we take our chances. So goes the life of any pilot.

Are these feelings familiar to you? Am I the only one who has such doubts and fears during a maiden flight? Either way, please share with me and other readers the thoughts that run through your mind while making that feared but unavoidable maiden flight with a new airplane. I'm very interested in hearing your comments on this subject.

That's all I have this month. Don't forget, we'd love to see photos of your latest projects and favorite models. You can send a digital photo by email, or mail a CD with many photos. I don't recommend sending prints, however, as I don't have the means of scanning photos into digital files. Mailing prints to me to be forwarded to Tony who then sends them to Gordon may result in lost photos.

So, until next month, fly big, and fly safe. See y'all at the field. *-Dick Pettit*

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HERE'S HOW...

by Walt Wilson

Share your best ideas and building tips with others. Send your "Here's How..." ideas to...
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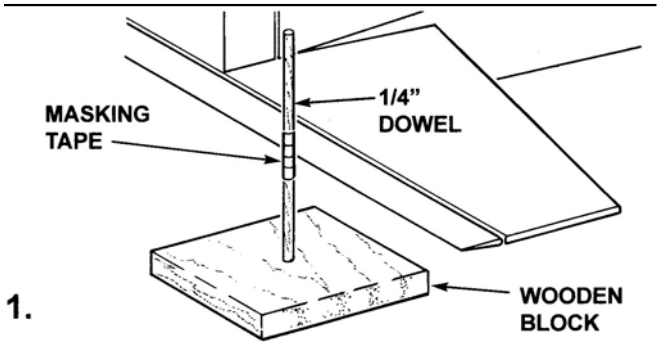
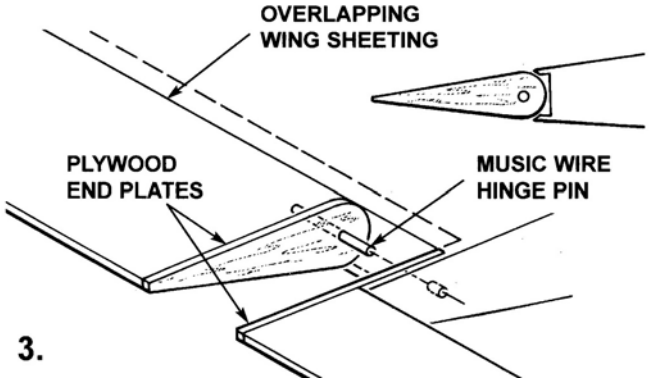
or by e-mail to... rallyo@charter.net
Please include your full name and mailing address. The first submitter of any idea used here will win a one year subscription or renewal to RC REPORT ONLINE. If the subscription or renewal is to be a gift to someone else, please state this when submitting the idea.



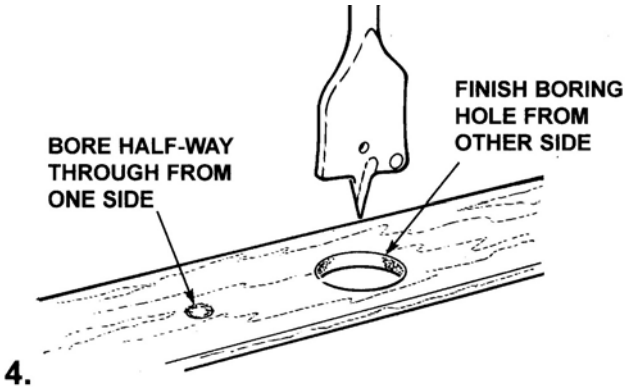


1. From Don Fitch, of St. Charles, MO. Most planes' instructions specify control surface throws in inches or millimeters, so Don devised an easy and accurate way to measure it. The base is a 1x6x6" piece of lumber, and the vertical is a 1/4" dowel. The base is held in a steady position by a weight of some sort. A piece of masking tape, with the center point of the travel and desired end points marked on it, is stuck to the dowel and aligned with the aircraft's control surface edge. You could also use tape or rubber bands to temporarily attach a short ruler.

2. (No Illustration) From Avey Shaw, of Huntington Station, NY. Avey has discovered the non-slip properties and high conformity of plain ol' styrofoam for use in lining the ends of clamps. The clamps will not slip off and with a little shaping of the styrofoam, most angles are possible to clamp. Save that packing material, it's second purpose may be more useful then the original!

3. From Al Poole, of Festus, MO. Al has come up with another way to make gap-free hinges for control surfaces. The leading edge of the moving panel is sanded to a radius. Matching plywood plates are made for each end of the control surfaces and the stationary surfaces. Holes are then drilled through each pair of plates in the desired hinge location. One plate is added to each end of the moving panel with the matching plate glued to the mating stationary surface. When the control surface is covered, or painted, and ready for final installation, music wire hinge pins are installed through the holes in the mating plywood plates and epoxied into whichever is more accessible. Wing sheeting is applied to extend beyond the stationary surface and almost touch the radial surface. When the control panel moves, there is no gap, regardless of its position.

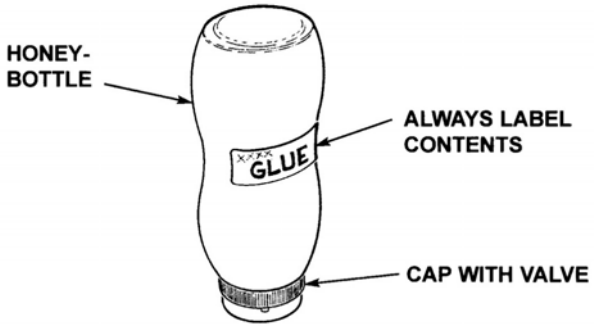
4. From Mark Immonen, of Ann Arbor, MI. Mark has a technique for drilling clean holes in balsa and light plywood, using spade-type wood-boring drill bits. They are commonly



4.

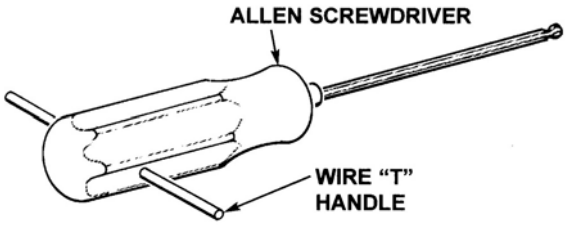
purchased in a set of six with bits that range from 3/8" to 1". This type of bit has one long barb in the center, two cutting edges on the sides, and looks like a spade, as the name implies. The spade-type bits are handy for large holes, but will frequently tear up the hole when you try to drill balsa or light plywood in one pass. The drill process creates a "donut" shaped piece of wood as you go through the material, which often breaks apart and spins around to damage the surrounding wood before you can pull the drill bit away, leaving an unsightly wood part. A drill press provides much more control than a hand drill, but may still present a problem. A better way to drill holes with the spade bit is to drill the hole in two steps. Drill half way through from one side (or far enough so the center point just breaks through the far side if the wood is thick). Then turn the piece of wood over and continue drilling the hole from the other side, using the small center hole as a guide. Apply slow, controlled pressure until you see the resulting donut begin to spin in the hole, and then immediately stop and retract the drill. Push the wood donut from the hole by hand and you'll have a nice clean edge on both sides of your balsa or light plywood part! For best results, always push the donut out by hand.

5. From Gary Keup, of Cedarburg, WI. Keep your white or resin-type glues handy and ready for use by storing them in one of the new honey, ketchup, ice cream topping, or any dispenser bottles designed to be stored on their caps. The sealed cap prevents leaking. The bottle should be thoroughly cleaned before filling with glue, of course. Regardless of how much glue remains



5.

in the container, it is immediately ready for use. A little squeeze is all it takes, and the glue is dispensed. With a little practice, a large amount or a small bead of glue can be applied. No mess, no plugged tip, and it's clean. (Walt's Note: When re-using food containers for other purposes, always re-label them to identify the true contents.)



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6. From Carl Malta, of Jamestown, NY. While working on your projects, have you ever needed more leverage when trying to loosen a tight screw? Carl's solution was to drill a hole through the plastic handles of his screwdrivers and hex drivers to make a T-handle. Just slip in a 3" length of music wire and you'll have far more power. (Walt's note: It might not be a good idea to *tighten* screws this way. You may twist-off the ball on the end of your hex driver, or round out the socket head in the screw if too much torque is applied.)

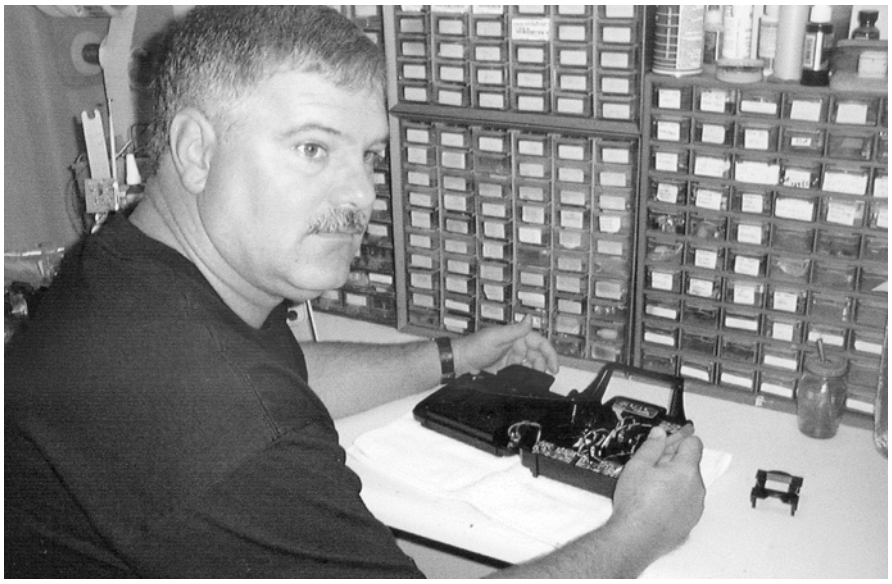
7. (No illustration) This one is from Howard Otchy, of Hillsdale, NJ. When using epoxy, Howard usually gets it all over his hands. He removes it easily by simply applying a few drops of his wife's hand or body cream, and rubbing it in thoroughly. Then wash your hands with regular soap and water and the epoxy is gone!

-Walt Wilson

(see addresses at top)

RADIO RAMBLINGS

by Tony Stillman



To PCM or PPM,
That is the question!

What's all this? Well, this month we're going to discuss the differences between PCM (Pulse Code Modulation) and PPM (Pulse Position Modulation), both of which are technically FM, even though PPM is usually referred to as simply FM. I'm constantly asked about the differences between these, and why some modelers prefer one over the other. Most people are not really sure what the differences really are, other than the fact that a PCM system is always more expensive than a PPM (aka, FM) unit. So what the heck is going on?

Let's start with the basics. We first had AM (Amplitude Modulation) systems. These were simple units that pretty much parallel the music radio history. There too we started out with only AM radio stations, but the high quality sound we demand is much easier transmitted using FM. Our R/C gear is really no different. The new microchips have made our systems very inexpensive to build, and the quality just keeps getting better. It was inevitable that we would move from our roots in AM over to the world of FM.

FM (which includes PCM and PPM, remember) still utilizes a pulse train made up of a pulse for each channel of operation. These pulses vary in length or "duration". Each pulse is decoded by the receiver and sent to the appropriate servo(s). As we move the stick on our transmitter, the pulse width for that particular channel is changed. The servo amplifier interprets this information and causes the motor inside a servo to turn the gears to follow the motion of the stick.

What then, is the difference between PCM and FM? PCM receivers have an onboard computer built in that monitors the noise level in which the receiver operates. This "noise" comes from many different sources, and will vary from flying site to flying site. It can be anything from a local TV station, an amateur radio operator using a high-power transmitter close by, or even a leaky power transformer on a power pole close to the flying site. Even other R/C transmitters operating on different frequencies are seen as noise. Most of these items are beyond our control so we simply have to live with them.

You can check the noise level of your flying field by contacting your AMA District VP and requesting the use of an AMA scanner. These units are pretty easy to use, and can help your club identify problem frequencies at your flying field. This is a pretty good service that AMA provides, and every AMA club should request a scanner at least once every two years, in my opinion.

If the noise level is below a certain amount, everything works normally. But once the noise level gets to a critical point, the onboard computer takes over. The data that the computer sees now becomes difficult to decode. Because the data is bad, the computer

decides to ignore it and replace it with data that has been stored in the computer's memory. What is this data? It's the settings the user stored while programming that particular model.

Most PCM transmitters come with default settings for the "Hold" mode. This means that once the interference level reaches that critical point, the servos are fed the last good data. In other words, if you're flying straight and level when the interference occurs, the airplane will Hold that setting until the interference ceases (or the model crashes). If the transmitter was set up with "Fail Safe" settings, then the receiver send the servos to pre-programmed positions set by the user when the Fail Safe mode was established. A useful example of this is to set the throttle channel for idle when interference occurs. This, at least, will give you an audible clue that something bad is going on! If you're paying attention, you'll quickly realize what's happening and focus your thoughts on what the appropriate action should be when the lockup ends. (The Fail Safe and/or Hold action is referred to as "lockout" by some pilots, alluding to the fact that the pilot no longer has control of the airplane, and are thus "locked out".)

An important fact to remember is that if the Fail Safe or Hold was not activated, the model would most likely crash anyway. I'm sure you've seen this at a flying site. It usually begins with the infamous cry, *"I ain't got it!"*, causing all eyes to turn skyward, looking for the troubled aircraft. By then it's usually doing some pretty wild aerobatics that the pilot is not normally known to perform! These "hectoflugaron" maneuvers quickly lead to an equally impressive impact with the ground, followed by moans from the crowd of onlookers.

As we all know, of course, the pilot is *never* at fault, it's always the equipment. So a long dialogue begins to try to determine what went wrong. Actually, in this type of scenario, it usually *is* a problem with the R/C equipment, or even more likely, a problem due to outside interference.

If we introduce Fail Safe or Hold into the mix, the wild aerobatics no longer occur. The pilot quickly knows something is wrong, however, since he's no longer flying the airplane. Realizing that the airplane has gone into Fail Safe or Hold, the first thing to do is call out, *"Is anyone on channel X??"* In a great many such cases, someone in the pit area has turned on their radio without the frequency pin. Remember, if the model is in Fail Safe with the throttle channel programmed to idle, the airplane is slowing down, which gives the pilot more time to think. If the culprit *was* another modeler in the pits, as soon as he turns off the offending transmitter, the flying pilot's control returns. The critical element here is time. If you think quickly, you give yourself a chance to save the model.

Without the PCM radio's Fail Safe or Hold feature, the pilot would still not be in control of the model during the interference! It would be jumping all over the sky, and his attention would be locked on the model, constantly trying to make corrections hoping that the airplane will eventually respond. The hapless pilot then usually "flies" the model all the way to the scene of the accident, without even thinking about asking if anyone else is on the same channel.

It's also important to remember that there would be no control of the throttle channel without the Fail Safe or Hold feature. That could mean that the model would attempt subterranean flight at full throttle, damaging more than just the airframe! Crashing a giant-scale model can be very costly, especially if you break an expensive multi-cylinder engine and/or a batch of nice, high-dollar servos! *(Editor's Note: Isn't the word "expensive" rather redundant when used to describe "multi-cylinder"?)*

So, the Fail Safe and Hold feature in PCM radios sounds pretty great, doesn't it? It's not a perfect system, but at least it provides a little extra time in which to react and do something useful. I generally recommend using PCM, and I

have it in most of my models, particularly the more expensive ones!

(Editor's Note: Counterpoint: I, on the other hand, have long avoided using PCM radios, partly because of their cost, and partly because I don't like the Fail Safe feature. Tony and I see this subject in very different ways. First of all, when Fail Safe takes over and sends the servos to their pre-set positions (usually something like high idle, neutral ailerons, a little up-trim, and slight-right rudder) or the Hold feature locks the servos in their present position, it could just as easily occur when the model is aimed at the ground (or toward people) as in any other position. Secondly, I fear that it will take a pilot more time to realize that he's lost control of a non-responsive model than one that begins thrashing around uncontrollably. What I have personally seen twice when a PCM radio's Fail Safe feature took over, was a pilot who spent valuable time looking down at his transmitter to see if it was still working, well before he finally gave the "I ain't got it!" warning. Furthermore, a model that's wildly thrashing around is just naturally approaching the ground at less speed than one that's flying straight and smoothly... directly at the ground. Also, when a pilot gives that "I ain't got it!" warning, and everyone's eyes turn to the sky, a wildly thrashing model grabs your attention more quickly than one that's flying nice and smoothly, right at your head.

And now, saving my main complaint for last; When an interference lockout occurs, the PCM receiver remains in lockout until it checks and verifies that the interference has passed. This takes a minimum of one full second after the initial interference, so the pilot is often locked out for two seconds or more, even if the interference was only a very brief "hit." If using a PPM/FM receiver without the Fail Safe feature, however, the pilot regains control immediately when the interference ends, so his loss of control lasts only as long as the interference. How many times have you experienced a hit of radio interference so brief that it caused no more than a sudden "blip" of one or more channels? By the time we realized we'd been hit, it was all over and we had control again. But now imagine having lost control (being locked-out) for one or two full seconds every time that happened. How many models would you have lost? Some years ago, at a prestigious pattern contest, very brief hits of interference caused so many Fail Safe radios to lock out the pilot for seconds at a time, there were numerous crashes and so many one and two-second flight interruptions, the pilots using Fail Safe radios were sent scrambling to find PPM/FM receivers so they could compete. The FM radio guys were getting hit too, but the very brief hits were far less troublesome. (To be fair about this, however, since the average person's "realization response time" is typically about 3/4 of a second, most of a one-second lockout will have passed before the pilot even realizes he's been locked out. Still, a model travels (mph times 1.47) feet per second, so losing control for a full second (or more) often means getting out your Visa card.)

The Bottom Line? There are so many pros and cons to the Fail Safe feature, PCM radios have neither taken over nor disappeared. It's much like choosing between radio brand names, because we have so many people flying on both sides of the fence. You should thoroughly educate yourself on the facts and details about the features in any receivers you're considering before making your choice. I'm guessing that the majority of R/C modelers already know that most or all PCM transmitters include an optional PPM/FM mode (when using a matching receiver), but not all PPM/FM transmitters have an optional PCM mode, so this is pretty much a "receiver issue". But here's something many people don't realize about PCM receivers: You typically have to choose Fail Safe or Hold. Few (if any) PCM receivers allow shutting off both forms of Fail Safe.

Note too that some third-party PPM/FM receivers have a Fail Safe option, and it's also included with most of the new, 2.4 GHz Spread Spectrum radio systems.)

More on Battery Charging

We've talked before about battery charging rates, and I stated that the C/10 rate is the minimum rate we should use. Well, I've done some homework to see why this is so. After some discussions with manufacturers and design engineers who are knowledgeable in the field of NiCd batteries, I found that I was incorrect. See, we can all learn something every day if we try!

Let's discuss this again, beginning with a little background information.

Most overnight chargers are set to charge at the rate of capacity divided by 10 (C/10). This rate was established more out of convenience than by design, and became known as the "overnight" charge rate because it will fully re-charge the battery while you sleep. This seems pretty logical, but let's get a little more technical for a minute (I'll try not to over-do it!)

The charging efficiency of NiCd cells is about 83% for a Fast Charge (C/1 to C/0.24), and 63% for a C/5 charge (note again that "C" stands for the rated capacity of the cell(s)) . This means that at C/1 you must put in 120 Amp hours for every 100 Amp hours you get out. The slower you charge, the worse this gets. At C/10 it's 55%, and at C/20 it can get down to less than 50%. (These numbers are just to give you an idea of the numbers we're looking at. Cells made by battery manufacturers will differ.)

When the charge is complete, oxygen begins to be generated at the nickel electrode. This oxygen diffuses through the separator and reacts with the cadmium electrode to form cadmium hydroxide. This causes a lowering of the cell voltage which can be used by a smart charger to detect the end of the charge. This so-called "minus delta V/delta t bump" that indicates the end-of-charge is much less pronounced in NiMH cells than NiCad, and it is very temperature dependent.

As the battery reaches the end-of-charge, oxygen starts to form at the electrodes, and be recombined at the catalyst. This chemical reaction creates heat, which can be easily measured with a thermistor. This is probably the safest way to detect end-of-charge during a *fast* charge.

NiCd battery chargers should stop the charge when the temperature exceeds the maximum charging temperature, typically 45°C for a controlled fast charge, and 50°C for an overnight charge.

Overnight Charging

The cheapest way to charge a NiCd battery is to charge at C/10 (10% of the rated capacity per hour) for 16 hours.. A 100 mah battery would be charged at 10 ma for 16 hours. This method does not require an end-of-charge sensor, and it ensures a full charge. Cells can be safely charged at this rate no matter what the initial state of charge is. The minimum voltage you need to get a full charge varies with temperature, but at least 1.41 volts per cell at 20° C. A good charge procedure is to use a C/10 rate for 16 hours, then switch to a trickle charge rate (around C/20). There are several units out there that do that automatically, as well as after market items that will convert your "wall wart" overnight charger to a trickle charger after the 16 hours. One example is the "Li'l Trickler" that I'll review in a future column.

Faster Charging

Some NiCd cells are designed to be "quick chargeable." As a timed charge this is C/3 for five hours, or C/5 for eight hours. This is risky, however, because the battery should be fully discharged before charging. If the battery still has 90% of its capacity when the timer starts, there's a high probability that you'll overcharge and vent the cells. One way to ensure this *doesn't* happen is to use a charger that will automatically discharge the battery to 1.0 volts per cell before begining

the fast charge. The advantage of this method is to eliminate any chance of battery memory.

Fastest Charging

If a temperature or voltage monitor is used, NiCd cells can be fast charged at rates up to 1C (i.e., 100% of the battery's rated capacity for 1.5 hours). The termination can be done with "minus delta V" detection (when the battery voltages *drop* 10 to 20 mv per cell). This is what we commonly call "peak charging".

To terminate the charge based on temperature requires a temperature slope measurement, which actually is available with some chargers today.

Trickle Charging

In a standby mode you might want to keep a NiCd battery topped off and ready to use, without overcharging and damaging the cell(s). This can be done safely at a current between C/20 and C/16. Many aftermarket chargers automatically switch to trickle upon peak detection, or after 16 hours.

So, it seems that we *can* charge batteries at a charge rate less than C/10 after all. It seems almost universally agreed, though, not to go any lower than C/20. And due to the inefficiency, if you use the C/20 rate you must multiply the time requirement by 2! For example, if charging a discharged 1000 mah NiCd battery at the C/20 rate, how long must we leave it on charge? You might think 20 hours as 20 times 50 ma equals 1000 ma. Wrong! Since we're charging at such a low and inefficient rate (50% or less), we must *double* the charging time to *40* hours! And since C/20 is a safe trickle-charge rate, you can leave the battery on charge even after the 40 hours has passed!

So, I hope this new information will help you properly maintain your batteries. *(Editor's Note: Tony has just verified something I've been doing successfully for years. Although I use two of the very fine Hobbico Accu-Cycle Elite battery chargers for my modeling batteries, I've never made up connectors for the batteries that power my two cordless drills. Since I have two or three batteries for each drill, whenever the battery in the drill runs low, I swap it for one that's fully charged. The discharged battery is then connected to its peculiar charger, which in turn is plugged into a TME "Auto Trickle Adapter". The battery is then trickle-charged for days, weeks, or even months until it's needed again. Plugged into this one "Auto Trickle Adapter" I have two cordless drill battery chargers, one cordless saw battery charger, and four glow plug battery chargers, so all these batteries are trickle charged for as long as they sit there. Works for me!)*

-Tony Stillman
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Wife: "Honey, do you want dinner now?"
Husband: "Sure! What are my choices?"
Wife: "Yes and No."

Bird on a Wire

by Terry Dunn

So far, I really like this new, online format. The main reason is that these words go from my keyboard to your screen in about two weeks. Taking the printer and the mailman out of the loop has really streamlined things. Now it's up to me to take advantage of this by staying on top of the latest and greatest trends in electric flight. That can be a tough gig, though. Much like computers, sometimes the ink on the receipt for your hot new Whiz Bang Flying Widget is still wet when the Whiz Bang Flying Widget Mark II hits the shelves. But I'll do my best and I welcome your contributions.

In my previous column, I explained some simple modifications I made to the power system of a Simpli-Fly 40 that I use for towing gliders. I reduced the down thrust in the motor and traded the 6-cell A123 battery for a 4-cell LiPo. The desired results of these changes were to reduce the forward speed required to climb, and to get more flying time per charge. Traditional scientific method would dictate that I make just one change at a time and observe the results of each. Sure, I can see the benefit of that methodology, especially in this case where each change will likely impact both the climb speed and duration. But my flying time is much too unpredictable and infrequent for me to be so rigid with my testing. So I made both changes to the Simpli-Fly and waited for the wind to cooperate. And I waited, and then I waited some more. Finally, after three weeks, I got tired of waiting.

Any modeler who likes his airplane and has a lick of common sense would have taken one look at the wind sock and immediately headed home. As for this modeler, one out of two isn't bad, so I set-up the Simpli-Fly and took off into the prevailing gale. It was actually kind of fun at first. But once the novelty of displaying backwards flight for my son wore off, I realized just how bumpy and rough the air was at ground level. I got my plane back on the ground in one piece, thanks to finely honed senses and cat-like reflexes (often referred to as "luck"). However, as test flights go, it was a total bust. I didn't learn a thing about how the modifications may have affected the airplane's performance. It was just too windy.

Two days later the wind finally calmed and I was able

Photo 1: Dennis Vollrath shows off his scratch-built Streak 150 along with its inspiration, a Great Planes Electrostreak. Dennis powers the Streak 150 with a Hacker brushless motor and A123 batteries.

to make another, slightly more useful flight. So far the results are promising. The airplane has plenty of climbing power, and even more importantly, I was able to climb at a seemingly slower speed than before. I flew for six minutes and still had plenty of juice left in the battery when I landed. So, my initial impression of the results is positive. You'll notice, however, that my observations are not very specific ("seemingly", "plenty", etc.). That's because the whole idea was to change how it flies when towing a glider. Once I have a chance to meet up with my aerotow partner, Lee Ray, I can form my final verdict.

Meanwhile, I received the following email from Dennis Vollrath regarding the battery swap on my Simpli-Fly:

"Hi Terry, I think I speak for a lot of people who would like to welcome you and the whole "R/C REPORT" team back!

"As for your comments on your 6S1P A123 pack, and only getting two flights per charge, I'm certain you know that these packs can be recharged at the field in 15-20 minutes, depending on how far you discharged them. I'm flying two 6S2P and one 5S2P A123 packs in three different models, and am charging them at 10 Amps..."

Dennis is exactly right. One of the main selling points of A123 cells is that they are very tolerant of high charge and discharge rates. As he says, you can fly them, throw them on a quick charge, and fly them again indefinitely. These cells are great for folks who want the high energy density of a

lithium-based cell, but are concerned about the inherent fragility (both physical and electrical) of LiPo's.

The next obvious question would be: If Dennis is right about fast charging A123 cells, why did I bother converting the Simpli-Fly to LiPo's? Well, there are two reasons: First, this rather simple project aimed at "changing the input voltage while maintaining the same power output" provided a handy opportunity to discuss the topic of "power system tweaking." I think it's a very important aspect of electric flying, and one that I'll touch on frequently. This was a good way to crack the lid, so to speak.

Secondly, I don't like to charge batteries while I'm at the flying field. I go to the field to fly and socialize, not to fiddle with chargers. I generally take a charger or two just in case, but I hardly ever *plan* to charge a battery during an outing. I have multiple batteries for all but my largest planes, so I can still enjoy numerous flights. This is really just a personal preference, however. If field charging doesn't bother you, the relatively low capacity (2300 mah) of A123 cells will not be such a limiting factor.

I asked Dennis to send more information about *his* A123-equipped planes. My favorite is his Streak 150, seen in **Photo 1**. Dennis took the plans for Tom Stryker's "Electrostreak" (once kitted by Great Planes) and enlarged them 150% for his up-sized version. The Electrostreak was one of those pioneering designs in electric flight that was able to achieve sporty performance with a humble direct-drive can-motor and a NiCd battery. That in itself says something about the soundness of the original design, and it has remained popular all during its 30 year history. Perhaps that's why Great Planes introduced an ARF version of the Electrostreak a few years ago (now discontinued). Strangely enough, in this era of brushless motors and LiPo batteries, the ARF included a direct-drive brushed motor and provision for a NiMH battery…perhaps just for the sake of nostalgia.

Here are the specifications of Dennis' Streak 150 in his own words:

"The model is called "Streak 150" as labeled on the wing, based on a 150% blowup of the original Electrostreak. The wing span is 65", the wing area is 850 sq.in., its empty weight is 85 oz., or 128 oz. (8 lbs.) ready to fly. Wing loading is 21 oz./sq.ft.

"The power setup is a Hacker A50-12S with an APC 14x12E prop, 6S2P A123 2300 mah cells, and a Castle Creations 60 Amp ESC. The Hacker motor pulls a measured 56 Amps at 17.5 VDC on the battery at full power. (Author's note: That works out to 980 watts, for a power loading of 123 watts per pound, indicating strong aerobatic capabilities)

"This is the second season on the A123 cells. Peak RPM actually increased by a few percent from when the batteries were new. That is, after a measured 245 Ampere Hours cycled through each battery pack, as measured by my on-board Amp hour meter, which accumulates total flying time, total Amp hours, and more, for the entire flying season.

"Flight times are on the order of six minutes with full acrobatics, taking about 2.6 Amp hours out of the battery during a regular flight. I like to leave extra in the batteries for emergencies, go-arounds, etc. These A123 batteries quit like a glow engine when fully discharged. And that's with a soft power down on low battery in the ESC programming!"

If you're wondering what "6S2P" means, it's relatively simple. It basically denotes that you have two six-cells in series batteries (6S) wired in parallel (2P), for a total of 12 cells. This arrangement provides the voltage of a 6-cell A123 battery, with twice the capacity. The nominal voltage of each A123 cell is 3.3, so a 6S pack has 19.8 volts. The capacity of a single pack is 2300 mah, so this 2P arrangement will deliver 4600 mah. When charging at 10 Amps, as Dennis does, each 6S battery will see half of that charge current (5 Amps).

Photo 2: This plastic case made by Plano was designed to hold up to four pistols. But priced at only $14.99, it also makes an economical dual transmitter case.

Photo 3: The Plano case is also a handy flight box. It has ample room for one transmitter and the usual park-flying accouterments. Note that I place my batteries in a smaller case to keep them from rattling around.

This will charge a fully depleted battery in about 30 mins. The A123 cells can be charged at even higher rates if you choose to do so.

Now, if ya'll haven't figured this out yet, I'm pretty frugal. I don't mind spending money, but I strive to get all the value I can, so I tend to pinch pennies sometimes. Being frugal is not a handicap if you're also resourceful. I was able to exercise both of those traits recently when I was shopping for a dual transmitter case. I was disappointed at first, that most of the cases I found were those expensive aluminum units. Then I thought I'd struck gold when I found a plastic transmitter case from Hobbico (LXUU48) for $21.99 on Tower Hobbies' web site. But I didn't commit because the description said it would fit two "smaller" transmitters, so I wasn't sure if it would fit the standard size transmitters I use. I also wanted to be sure that it had sturdy hinges, which I couldn't see in their online photo. If any of you have experience with this transmitter case, I'd like to hear from you.

A few days later, though, I found what I wanted. A local sporting goods store had a plastic case by Plano (#1404) (see **Photo 2**) intended for four pistols. It appeared to be the size I needed, and it felt sturdy. Best of all, it cost only $14.99! When I got it home I was happy to find that it accepted any two of my 2.4 GHz or 72 MHz transmitters. There isn't much extra room, but they fit.

The box comes with three layers of foam. Two are egg-crate style, and one is a 1-1/4" thick layer with perforations which make it easy to remove material for a custom fit. With one egg-crate layer and the perforated layer in place, the

Photo 4: Al Knight's SAAB J-21 has gone to a better place, but he has no regrets about tackling this unusual scale subject.

case snuggles the transmitters tightly, but not so tight to cause concern about breaking switches.

This case is also perfectly sized for me for park flying sessions. I can store one transmitter, several batteries, and still have room left over for some simple tools and a spare prop or two (see **Photo 3**). If I'm going to fly in a rough neighborhood, I could even fit in a pistol as the folks at Plano intended!

The first time I used my new case was for a lunchtime park flying session with a friend I hadn't seen in a while. I was all set to show off my resourcefulness and creativity, when I noticed that he was using the very same case in exactly the same way! The only difference was that he'd been using his for months! Oh well. In any case (no pun intended... well, okay, maybe a little), I plan to buy a couple more of these Plano cases so that I'll have enough to store and transport my transmitters, and have one dedicated just for park flying.

I'd like to close this month with a brief discussion of Al Knight's impressive SAAB J-21 (see **Photo 4**). Despite the airplane's recent crash, I think you'll agree that this SAAB story is no "sob" story. Several months back, I received an email from Al describing a B-25 (seen in **Photo 5**) and the SAAB J-21 he'd scratch-built using the techniques described in Keith Sparks' book *"Building With Foam"* (available at www.parkflyerplastics.com). Both planes look great.

Al and I swapped numerous emails discussing the SAAB's power system and how to calculate the proper CG for its double-tapered wing. Throughout the winter, I'd send Al an occasional light-hearted prod to maiden the J-21, and I recently received the following update:

"As for my latest E-power effort, I must report on the demise of my SAAB 21 ! Let's just say it was due to pilot error and let it go at that! Your CG calculations were right on, but I had way too much control surface movement on the elevator, and it got away from me eventually, but it was a thrill to see in flight after starting out with only a 3-view. No regrets, as this is what it's all about as far as I'm concerned. Anybody can buy a flyable plane ready-

Photo 5: Like the SAAB, Al Knight built this electric B-25 out of foam. Both models display the excellent results that can be achieved with this medium…especially when replicating compound curves. Well done Al.

built nowadays, but they don't get the enjoyment and pride one gets when starting out with only a blank sheet of paper!"

Amen brother! Al and I think alike on this issue. I build my share of ARF's and kits, but the most rewarding projects tend to be those that start off in my head. Seeing your intellectual and tactile handiwork take flight, even if only briefly, is tremendously rewarding. As I always say (really, I do), "Tis better to have flown and crashed than never to have flown at all!" This, of course, assumes that we walk away from the crash with as few torn and burned clothes as possible.

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SPARKY'S REVOLT

by Tony Coberly

RC REPORT ONLINE

Hello everyone. The past few months have been very busy for me, but I must admit, it sure has been fun. Stressful, but fun! The new RC REPORT ONLINE launch at the Toledo show was an eye opening experience, and I was very happy to talk to the hundreds of people that came by our booth to talk about the former magazine and the new website.

By the way, there's still some confusion about the relationship between *"R/C REPORT"* Magazine, and RC REPORT ONLINE. They are two entirely different businesses, with the former gone and the latter still emerging. Gordon and Mina owned and operated the magazine, and I wrote for them. Julia and I own the online business, and now Gordon and Mina write and edit for us, although I sometimes get the feeling that *I* work for *everyone*! Gordon somehow never got around to fully explaining who's held responsible for errors, no matter who makes them! *(Editor's Note: I didn't mention that? Oops, must be your fault.)*

Anyway, getting the new website built, launched, and de-bugged has taken up most of my time over the past few weeks, so this month's column is going to be somewhat shorter than usual.

SPARKY'S REVOLT

This month we'll continue with the discussion about my 50cc Extreme Flight Yak conversion. I talked about the motor and 10-cell power system last month. This month we'll cover a little more about my 12-cell setup and the issues it caused. I said "it caused" because I'm already weary of taking the blame for stuff!

I used an Oracle onboard data recorder during flight with my 10-cell LiPo batteries, and the performance was very good. It yielded a maximum wattage of 3900, and a max current of 101 Amps. This provided great power and excellent performance, but... hey, this motor is capable of *6000* Watts! And since I'm not even close to that number, it's time to explore some options and "kick it up a notch.".

How do I increase the motor's power output? I have several choices that will yield higher numbers, but I need to be careful because more wattage doesn't always mean more power. Sometimes it only means more heat! First and probably most costly is to simply use more cells in the batteries, which brings us to the 12-cell packs. As I mentioned last month, this just had to happen, and it did. I installed a new set of 12-cell 5000 mah batteries in the Yak, and to the field I went!

As I ran the motor up just ever so slightly, a fellow club member turned to me and asked, *"Why is the ground shaking?"* I just smiled, and laughed a little as I taxied out onto the runway. I then ignored my own test-flight rules, and decided to just fly and see what

happens. Well, it ran down the runway straddling the centerline beautifully, and then rotated into the sky. All was going fine. Then I nailed the throttle hard, and as it turned out, that was a really bad idea. The motor screamed in protest, as the Castle Creations Phoenix 110 HV ESC poured on the coals (aka, Amps). Sadly, this was *not* the kind of scream I wanted to hear! I immediately reduced power to half throttle, came around the circuit, and landed. There was no smoke trail, there was no melted canopy, so all was well, right?

So I ran the motor up in the pit area again, and the same scream was heard again as I neared full throttle. Frankly, it sounds like something in the motor is coming apart, but it turned out to be a weird harmonic the motors gives off when it gets out of sync with the ESC. When this happens, by the way, the current flow in the ESC goes sky high, so never ignore it! It's kind of like trying to drive a stick shift vehicle while it's in 5th gear and in reverse at the same time. In short, it ain't good.

I decided to get out my TME Xtrema wattmeter and measure the current draw. Yes, I should have checked that before I flew. I ran up the throttle with the Xtrema connected between the battery and the ESC, and watched the numbers climb, climb, and climb. They climbed so high, in fact, that the screen went blank and came back with "ERR". Hmm, this is interesting! It seems that I'm pulling more current than even the Xtrema can read! I disconnected everything and powered up the Xtrema again. Thank good ness it was still working.

Photo 1: My parallel adapter for two wattmeter inputs

Now without a way to measure current and watts, I have no idea what my motor and ESC are doing, so how do I measure it? The Xtrema is a great wattmeter and charger, and personally I think it's the best on the market. But now that I have entered the "insane power" range, as Gordon puts it, now what do I do? *(Editor's Note: Want me to look up the number for NASA?)*

The Xtrema wattmeter is capable of 100 Amps for a few seconds, and the Xtrema is the top of line for watt meters as far as I know. But at least now I know I'm pulling more than 100 Amps. I saw that with my onboard Oracle meter too, which is also rated at 100 Amps maximum, so I guess it's time to try something a little more sideways: I'll use a pair of meters in parallel! In theory, if I have two watt meters set up so that my 12-cell LiPo battery pack provides input power to both meters, and my ESC is connected to the output of both meters, this should allow the current to flow through both watt meters. Theoretically I should have only half of the total current going through each meter, and therefore I should have a measuring capacity of 200 Amps! In theory, that is. In LiPo speak I have 1S2P watt meters! So now it's time to go to the shop, and make some adapters.

I'll need two adapters to make this work. First I need to split the 12-cell LiPo into two 12 outputs. I have a single male connector onto which I have soldered short, 12 gauge leads. I then take two female connectors and solder two 12 gauge leads onto them. Now I solder the red leads together, and then solder the black leads together. I used some rubber tape for insulation, and I have one adapter ready (**Photo 1**).

Photo 2: My output parallel adapter is readily available from hobby shops.

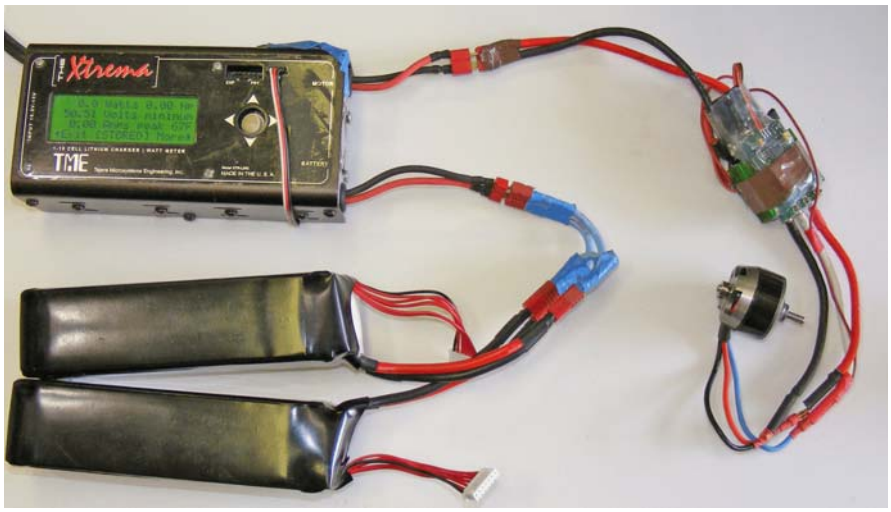

Photo 3: A basic single wattmeter setup.

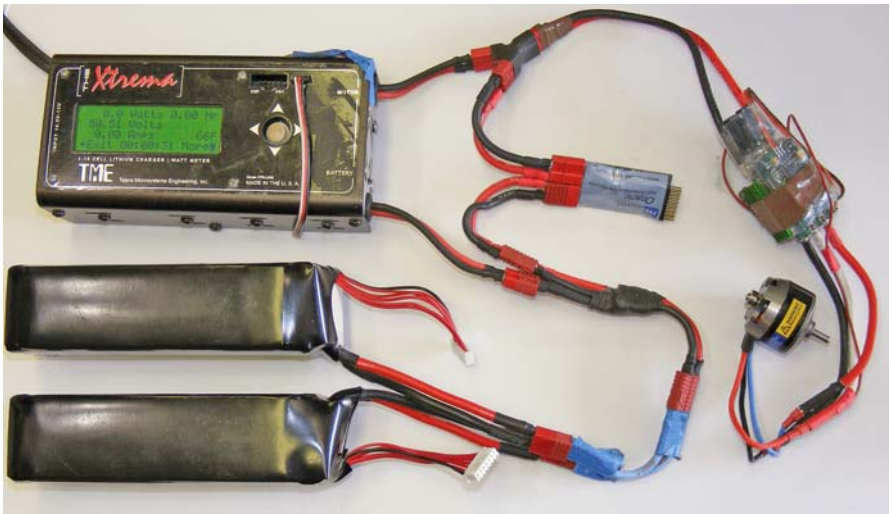

Photo 4: The advanced dual wattmeter setup.

Now I need to make a connector that's basically the opposite of what I just made, using two male connectors that convert to a single female connector. But wait... maybe I don't have to make one after all. I used to have a small sea plane that used a single motor with multiple batteries. Low and behold, I dug into the "hoarder pile" and pulled out exactly what I needed (**Photo 2**). These are available from most hobby retailers.

Now that I have the adapters, I can look at a standard testing setup (**Photo 3**). Here I have my Xtrema wattmeter connected between the 12-cell Lipo and the Castle Creations Phoenix 85HV ESC. Obviously, this is just a mock up, because with everything installed in the plane it's a little hard to see what's happening. Now I have a picture of the situation with two watt meters in parallel. One is the Xtrema, and the other is my Oracle data recorder (**Photo 4**). Now I can run my test and just combine the data from the two meters. Then I'll have my maximum Amps up to 200. Ideally, I would be best served to use two of the same watt meters. Using different meters means there will be slightly more or less resistance in the circuitry of one over the other. When you're working with high voltages and currents like these, a small difference in resistance can result in exponentially larger differences under loaded conditions. If you use two of the same watt meters, the difference between the two should be very low or nearly zero.

My setup yielded an Xtrema recording of 56 Amps, with the Oracle showing 65 Amps, for a total of 121 Amps for the system! (See **Photo 5**). The setup may be ugly, but it works! Now I know that I do

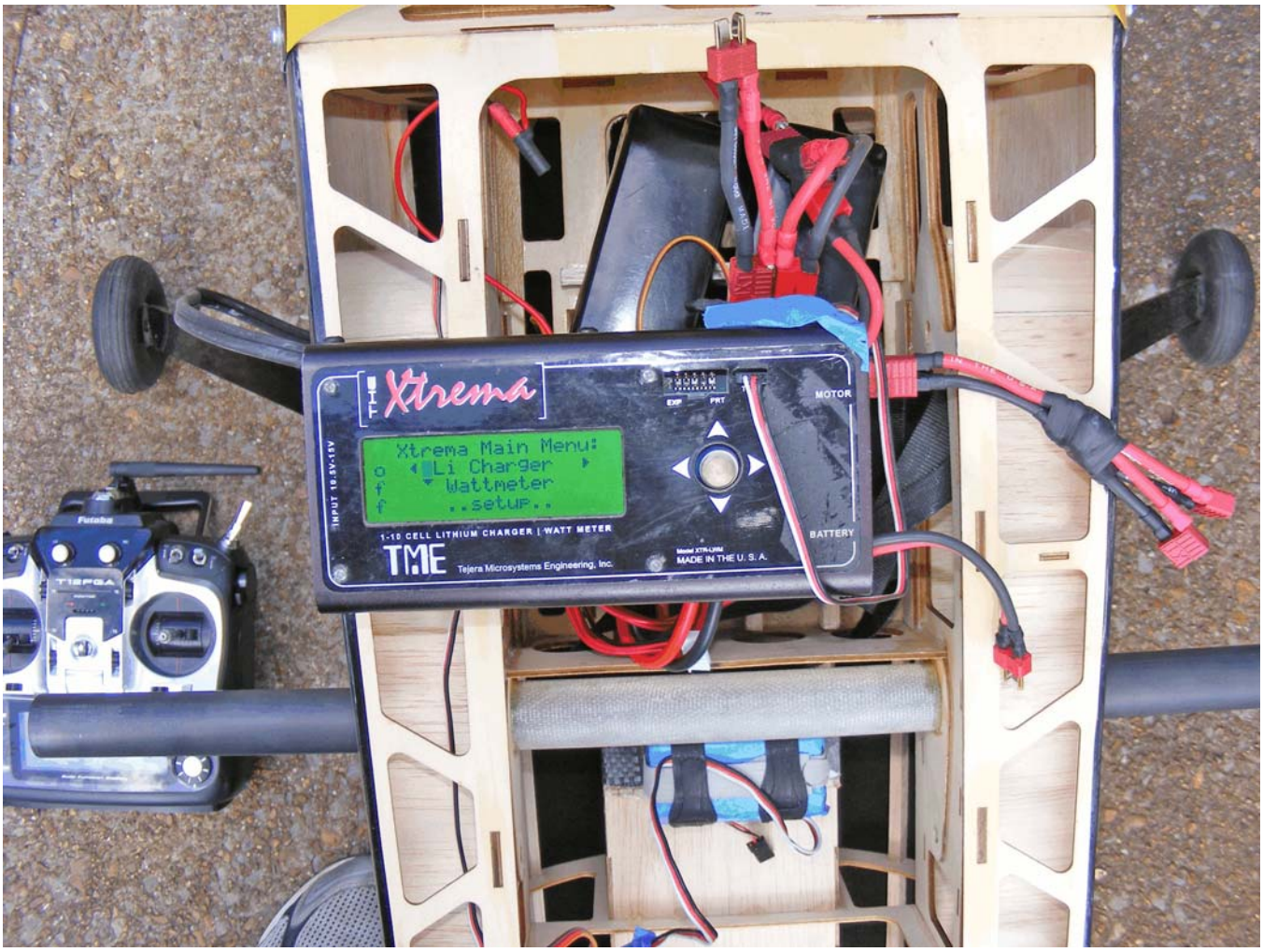

Photo 5: The actual setup during testing. It's hard to make something like this look good! ***(Editor's Note: What a coincidence. The doctor said those very words to Tony's parents the day he was born!)***

not want to use more prop right now, because I'm already 11 Amps over the maximum rating of the ESC! The plane performs very well with a total of 5200 watts and the 12-cell 5000 mah batteries. The vertical climb is truly unlimited, and the throttle response is to die for. The 24x12E APC propeller pulls the plane hard, but perhaps with more speed than the plane (or I) needs. I think next I'll experiment with a larger prop having less pitch. I don't need the speed that 12" of pitch provides, but I want all the static thrust I can get. I think I'll see what happens with 26x10 or 28x8 props, just for comparison.

Well, I have to run now, so that's all for this month. Please feel free to contact me about anything you would like to see in this column, or at the RC REPORT ONLINE website. We're still working through several small issues and bugs, but we're getting there! I hope to see you here agin next month. *-Tony Coberly*

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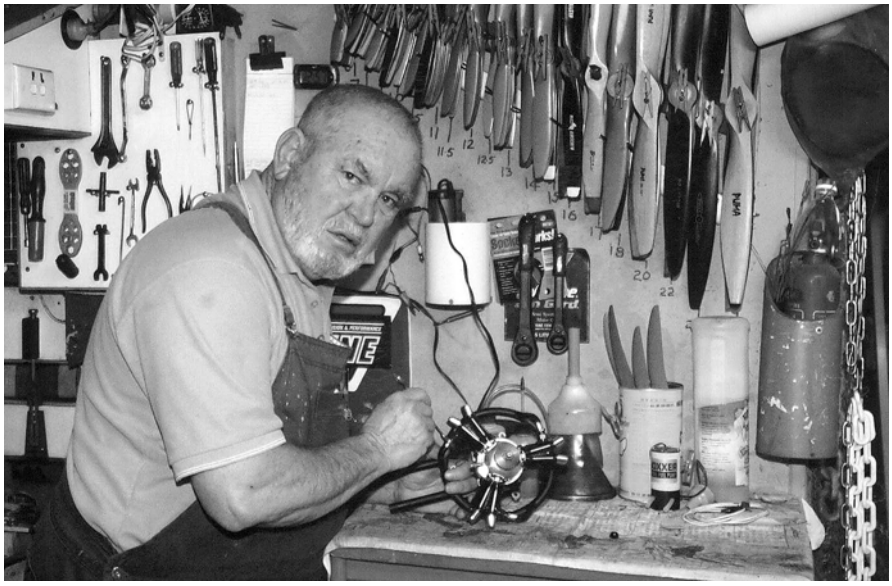
The Oily Hand

by Brian Winch

ENGINE REVIEW
O.S. FSα-110, Single Cylinder, OHV, Four-Stroke, Ringed
Displacement. . . . . 18cc (1.098 c.i.)
Bore/Stroke. 30.4 x 24.8mm (1.197 x 0.977")
Weight . . . . 600 g (21.16 oz.)
Advertised HP. . . . . 1.8 PS @10,000 RPM
RPM Range. . 2,000 - 11,000
Suggested Prop Sizes 13x9 to 17x6
Suggested Fuel 18% oil + 5-20% nitro
Crankshaft Thread UNF 5/16 - 24
Includes. . . . . Glow Plug, needle extension, muffler assembly, instruction manual, and O.S. decals.



The new O.S. FSα-110 (α for 'alpha')

Why a 1.10 size engine? My thoughts are that the .90 - .91 engine class is well catered by a number of brand names. With several top-line engine brands available, it can be hard to choose if you're not wholly dedicated to the O.S. brand. So O.S. has sweetened the deal by offering this slightly larger engine in their .91 crankcase so it fits wherever their .91 will, but packs a few more 'horses under the bonnet', so to speak, without any compromises to overall performance. An engine can be 'modified' to give a bit more power, but, generally to the detriment of *overall* performance. It might become more difficult to start, it may vibrate a bit more, maybe it won't idle smoothly any more, and perhaps the mods will take a toll on internal components through accelerated wear. The best way to increase power without compromising other aspects of performance is to 'up the anti' and simply increase the capacity. And that's exactly what we're seeing here, an increase of 3cc capacity which is nice for a wide range of models.

The first consideration would be for models designed for 15cc power that are a bit heavy or lacking good flight performance. The extra capacity will help brighten the flight performance, and the wider

Photo 7: All the oil gets sucked down this small drain hole.

Photo 8: Not a lot of room left here.

Photo 9: Acting as a centrifugal pump, the crankshaft flings the oil on its upward path.

choice of propellers suitable for the larger capacity will provide either better pulling power or greater top speed. The default propeller for a 15cc (.90) engine is usually a 14x6, and I look for performance close to 10,000 RPM. I recorded 9,800 RPM with a 15x6 prop, providing another 13% fan area at close to the same RPM, all in all a nice bonus. Or one might use this engine in a 20cc (1.20 c.i.) model that would benefit from a little less power, a smaller and/or lighter engine, and a smaller fuel tank. Consider a scale model that should never be flown fast but should be maneuverable with good pulling power, say a Tiger Moth for example. With this engine and a 17x6 prop maxing at 8,000 RPM, you only have to fly it smoothly to impress the judges.

As with the other engines in their "alpha" series, you have the usual O.S. high quality in design and engineering. This is coupled with a very modern appearance that not only looks pleasing, but incorporates some innovations that become apparent when the engine is used and, if ever needed, when disassembly is required for replacement of bearings, for example. One example of this is the removal of the wrist pin from the piston through an aperture in the rear of the cylinder. In the majority of cases the engine has a lot of time on the clock before it needs work such as bearing replacement. Subsequently there is a normal build-up of running deposits on internal parts. This has been a real problem when removing the wrist pin. Due to the very fine fit and lack of wear in the piston bosses, the slight build-

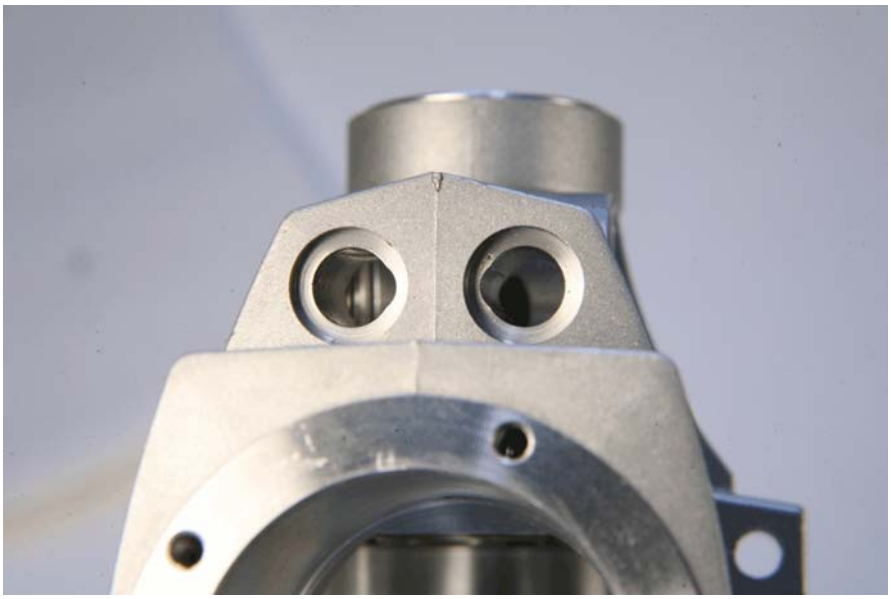


Photo 10: Slipping up the side of the cam followers in the grooves, the oil heads up the pushrod tubes.

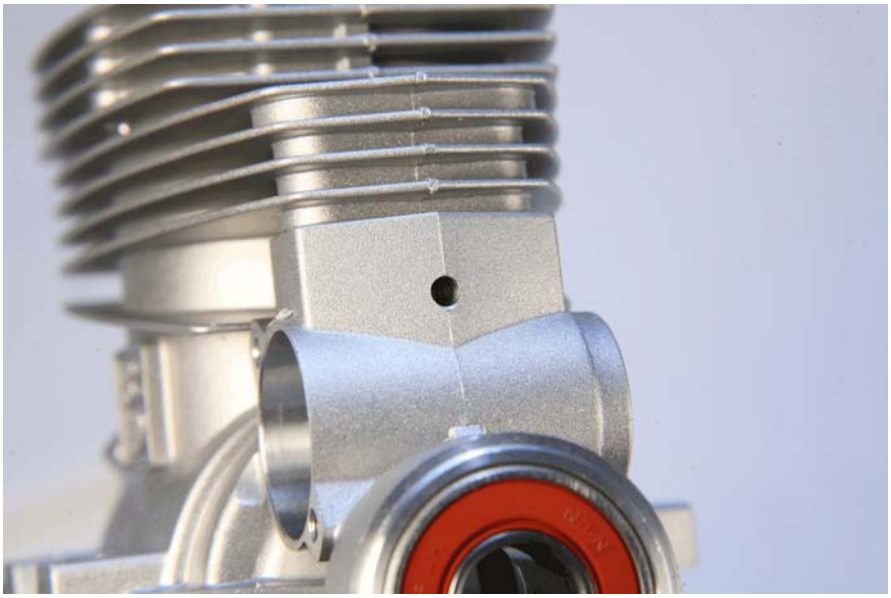


Photo 11: Handy hole in the front for removing the wrist pin from the piston and connecting rod.

up of deposits made the job of removal one that caused a lot of angst due to the pin's reluctance to be dislodged. Now, however, a couple of taps with a pin punch or a short length of appropriate diameter music wire and the job is done (with no swearing, either!).

Another feature that's raised a few eyebrows is the lubrication system. There is no crankcase breather nipple to expel the used oil distributed around the lower section and up into the rocker arm chamber. Lubrication is (almost) the same as with any model 4C engine using oil mixed in with the fuel. During combustion a small amount is forced past the piston, and an even smaller amount seeps up the valve stems during induction and exhaust strokes. It's a tiny amount, but when repeated thousands of times per minute according to the running speed of the engine, those tiny amounts add up. All internal parts are adequately lubricated and the oil (plus combustion by-products) are usually expelled out a breather nipple placed somewhere in the lower crankcase. In the Alpha series, however, the blow-by (the correct term for the lubrication system) oil does its job around the connecting rod and the rear main bearing, then travels up the center of the crankshaft where it's flung out from two holes (in this engine) to lubricate the camshaft assembly, its bearings, and the cam followers. Pressure then pushes it up the pushrod housings (lubricating the pushrod ends on the way) and into the rocker chamber to lubricate the rocker arms, valve springs, and valve stems. At this point it has completed its tour of duty, so to speak, so it is taken back into the engine via a jet hole in the head to be mixed with the combustion charge and expelled out the exhaust. The end result is adequate lubrication and a very clean area around the engine due to the lack of the messy breather nipple. Astute readers (those who were sitting up and taking notice) probably noted that I did not mention the front bearing in the lubrication path. I didn't because it isn't, since that one is a fully rubber-sealed and lubricated for life bearing, the makeup of which prevents the ingress of dust and other detrimental nasties.

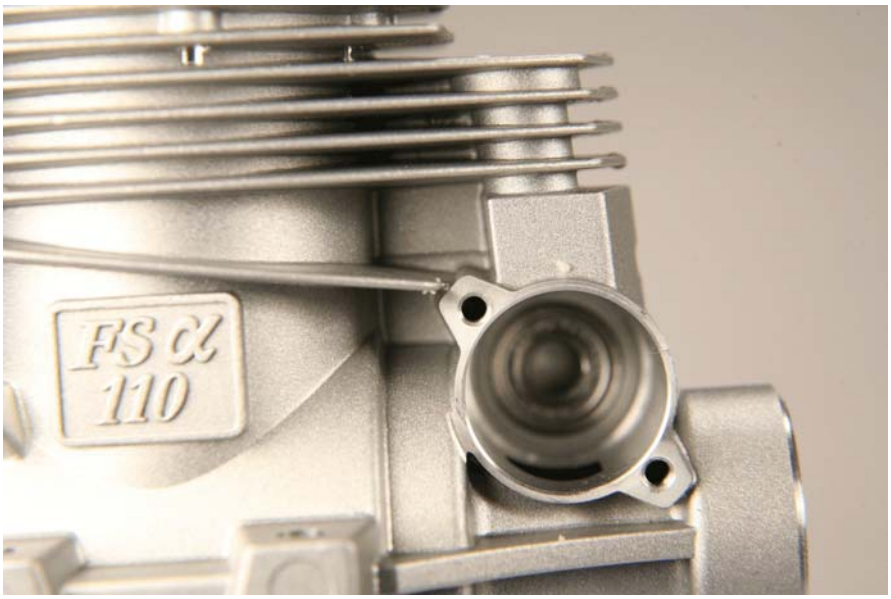


Photo 12: Finning on the cam follower housing keeps the area cool.

Photo 13: "Simply effective" is the best way to describe the carburetor.

Photo 14: Out with the dot, in with the slot: the new timing mark on the cam gear.

So, as you can see, there's lots of good news here, but now let's see how it performed and impressed me on the bench!

I gave the engine a run-in period and then carried out the testing and observations at 26°C (79°F) and 60% humidity. Consulting my notes, I recorded that the compression was close to optimum straight out of the box, indicating a superb piston ring fit. With a generous prime and the throttle set at 1/4 open (marks on the throttle rotor) the engine fired up on the first good flick of the prop. Throughout my testing, starting was always by hand, with no tendencies to kick back or bite the hand that flicked it. It was very responsive to throttle movement, with a smooth and rapid transition. While the cylinder head was normally hot, the crankcase was cool for a considerable running time (very free bottom end). Tuning was easy with a tolerance of generally around 1/4 turn of the needle, and the idle mix was perfect right from the factory. Running was smooth, with no abnormal vibration noted, and the engine still looked new after a considerable amount of running time. This was a very pleasant engine to run and test, and one I feel sure you will enjoy owning and using!

ON THE BENCH

For new readers and those who might have forgotten, the description and photos of parts are taken after the engine has

Photo 15: Only the essential sections for the lightweight piston. Note the wide gap in the ring.

Photo 16: Effective but not overly restrictive baffle for the exhaust system.

Photo 17: Mysterious holes in the rear cover.

been run-in and fully tested. The engine is then disassembled, and the oil removed in a bath of methylated spirit, but no further cleaning is done. What you see is how the engine looked after running, and my notes indicate what I observe during close and detailed inspection. Basically, what you see (and read) is what you get.

The crankcase is a single piece comprised of the sump (actual crankcase section), finned barrel, mounting lugs, front housing, camshaft housing, and cam follower support section. Additional parts completing the case (attached to the main casting) are the rear cover, cam housing cover, and the cylinder head. Dealing with the main section first, it's a pleasure to see the quality of the casting and machining. The composition of the aluminum alloy provides a tough material that, when machined correctly, produces a finished surface almost as bright and clean as chrome plating. From the rear, the opening where the rear cover fits has a small step at the rim, the four tapped holes for the attaching screws, and above this section is a 6.5mm hole for removing the wrist pin. Above this is the rear section of the barrel finning and this section is straight across, providing large corner sections for excellent heat transfer and dissipation. On each side are the mounting lugs in a semi modular design with the main sections (with the bolt hole) being 6.3mm (average - slight top taper) thickness with 4mm holes spaced 25mm apart.

Moving right along we come to the front housing with a distance of 31mm between the centers of the bearing thicknesses which provides quite adequate support and precludes any tendency for shaft flexing during severe maneu-

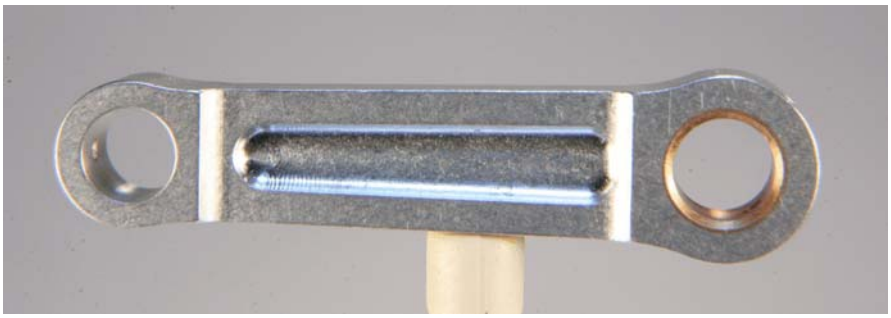


Photo 18: Sporting a plain and a bushed end, the connecting rod is a tough customer!

Photo 19: Previously the pushrod covers were formed from stainless tube. The new style is fully machined aluminum alloy.

Photo 20: I'd like a set of this rocker assembly simply to put on display! Very nice.

vers during flight. Curved webs further support the front housing to provide a very rigid but lightweight carrier section. Above the front housing is the cam housing, with the cam followers support pedestal forming the top section. This pedestal is continued as a dual column that has the front finning of the barrel extended around and culminating in an angled section at the front. As usual for an O.S. design, the camshaft is one-piece incorporating the two cam lobes, the cam gear, and the actual shaft, the whole thing being supported by shielded ball bearings on each end. The end cover for the cam housing is much shallower than previous designs, and is sealed by an O-ring. Above the bore of the housing, in the cam follower pedestal, is a 2.5mm hole that aligns with the center of the hole in the rear of the barrel. It's here that you insert a pin punch (or similar) to push the wrist pin out of the piston and the little end of the connecting rod. A question mark here will be discussed when we view the piston.

Looking down from the top, you can see that the two bores for the cam followers have a slight channel machined in one side of each. It's via this channel that the oil from the sump is pushed up to the rocker chamber. This oil would carry with it a considerable amount of engine heat that, in my opinion, is the reason for the extended finning. Excess heat is dissipated here before the oil reaches the top end. The tops of the cam follower bores are a lot deeper than previous engines to fit the O-rings that seal the pushrod covers to keep air out and the oil in. The pushrod cover tubes are fully machined from aluminum alloy, and fit deeply and snugly into the top of the cam follower pedestal and the underside of the cylinder head.

The rear cover is a familiar design attached by four screws. It's fitted with an O-ring that seats into a step machined in

Photo 21: Deep blue, finely embossed logo, with lots of quality underneath.

Photo 22: Sturdy cam case cover has an effective O-ring seal.

the rear of the crankcase. Two pillars extend from rear for mounting the carburetor. An interesting point is that the pillars are hollow for a depth of 15mm from inside the cover. This, I believe, is because solid pillars would create a hot spot, as the solid metal would soak up and retain heat more than the surrounding area, and then transfer that heat to the carb. Although there is a very small reduction in weight, I doubt that this was a consideration.

The combustion chamber in the head can best be described as having the shape of a bath with a side spa section. The 'tub' section of the bath is very crowded with the valves, and the distance between the two is less than 1mm. The inlet valve is 14.5mm in diameter, and the exhaust is 12mm. The length of the "tub" is just 29mm, so the valves have quite a cozy fit. The "spa" section contains the working end of the glow plug, and it's even closer in, almost impinging on the edge of the exhaust valve. All are very close, with no wasted space, but no actual contact, either.

At its deepest, the rocker case extends down just 19mm, serving as the reservoir for the oil expelled by the engine. A small hole is drilled and counter-bored into the rear of the inlet valve chamber for the purpose of draining this oil back in to become part of a fuel load as the inlet valve is opened.

A tall pillar in the rocker cavity supports the pleasantly shaped and finished rocker assembly, which is located in a slot and retained by a single cap-head screw. The rocker assembly is surface treated to deter corrosion. For the mechanically inclined, the rocker ratio is approx. 1.36:1, the cam lift is 3mm and the valve springs are 15mm long, retained by split, tapered collets. The rocker box is sealed by the logo-embossed rocker cover which has a deep blue surface treatment, all very nice from both an engineering and aesthetic view.

INSIDE MOVING BITS

The liner is almost a tradition with ringed (and lapped non-ringed) O.S. engines. As far back as the very first engines, hardened steel liners have been used. Maybe the method was developed and proven so successful that the need never arose to make a change. Certainly in the category of "if it ain't broke, don't fix it". Thirty or more years ago it was common knowledge that it was almost impossible to wear out the steel liner in an O.S. engine, and I personally know of modelers still using engines from that era on a regular basis, and still obtaining excellent performance. O.S. makes and supplies the goods, so if we look after it and keep it serviced, it will keep on giving good performance.

Looking into the liner of this engine with my 'close

scrutiny eyeglass' (aka, jewelers's loup) I cannot see any evidence whatsoever that this engine has been run, even though I know I've burned several liters of fuel during break-in and testing. It's tough stuff we're dealing with here!

The piston is fully machined from aluminum alloy and reduced to absolute minimum dimensions (less weight for a better balance and smoother running). One ring is fitted, and it has a bit more wall tension (contact against the cylinder wall) than I usually see. This is evidenced by the sprung gap measuring 3.83mm, quite a lot and part of the reason the engine had excellent compression before being run.

There is one point that I cannot quite grasp. As I mentioned earlier, the wrist pin removal is a simple job with the provision of the hole in the front of the cylinder. Still, I encountered a bit of a problem when removing the pin. As my pin punch was pushing on the wire circlip fitted in the front of the piston, the tail of the clip interfered with the punch. Why use a circlip here at all? Why not use a stepped hole in that side of the piston? The wrist pin is not completely hollow, leaving a short solid section in the middle of its length, so the pin punch can make contact there to push it out. There may be a reason for this, but I don't see it. *(Editor's Note: One possibility is that if only one wrist pin hole was stepped, the piston would then be a "one way only" fit. As it is, however, the piston can be fitted either way, simplifying assembly.)*

Of the total length of 24.5mm for the wrist pin, 5.6mm is a Teflon rub pad. This, coupled with an almost hollow section, reduces the weight of the pin for the same reason as noted for the piston. This attention to fine detail plays a big part in the lack of engine vibration.

The connecting rod is, like the piston, fully machined from stock aluminum alloy. The shank (the length between the eyes at the ends) is I-beam shaped, the big end is bronze bushed, and the little end is plain, with no bearing or bushing. I often wonder why some manufacturers go to the trouble of bushing the little end of their connecting rods. If the rod material is of a good grade, there's no need for a bushing here as the movement within the little end is limited to little more than a very small rocking motion. The rod is symmetric, but mark the rear side anyway if you have to remove it, to maintain the same wear pattern.

With a crankshaft like those in O.S. engines, I always consider it a shame that it has to be hidden. To me it's a fine piece of engineering that needs to be seen to be appreciated. It's extremely finely machined on all surfaces, heat treated high tensile steel alloy, and surface treated to assist in the prevention of cracks and/or corrosion. The shaft section (journals) is bored with three reducing diameters (weight reduction), the helical pinion (small gear section) is reduced in length to provide just the correct contact area (again, weight reduction), the 31.5mm diameter propeller drive hub is keyed to the shaft (also acts as a timing reference), the propeller washer is tapered face steel, and the lock-nut assembly does the job of holding the propeller in place. Two holes in the journals do the job of providing centrifugal pressure to send the oil from the bottom end up through the cam assembly, then up the pushrod covers to the rocker chamber. The furthest hole is right on the end of the last bore to ensure absolutely nothing is left in the way of corrosive liquid or oil residue to thicken and cause oil grunge.

GAS IN - GAS OUT

The 60Y carburetor is a smooth operating, easily tuned unit that's perfectly matched to the engine. To assist in its performance, it's fitted with an air trumpet (aka ram tube) that smooths out the column of incoming air before it flows over the fuel jet. The throttle barrel, a lightweight, smooth operating section, has three line references stamped on the throttle arm end to indicate closed, midway and fully opened, a nice aid when setting up the linkage, and also for checking the RPM at various openings. Other than an occasional cleaning inside, as suggested in the instructions manual, a very

slight change in the setting of the main needle for extreme weather changes is all this part requires to provide faultless service for an extended period.

The muffler is the newly designed F-5040 series comprised of a three-piece cast body and a fully threaded header pipe that allows for about 7mm adjustment in or out, and 360° positioning for the final outlet, as well as a full turn rotation for the stinger, all making a fine, multi-position design. A baffle is fitted between the two main body sections which are sealed with a heat resistant O-ring, and a pressure nipple is located just behind the joint in the front section. This appears to be a very effective muffler that will find approval even at noise-sensitive flying fields.

THE FINAL SPIN

I went well beyond the recommended propeller range as the engine exhibited excellent running characteristics even with the largest propeller recommended, so I considered that it would handle larger props without problems. My consideration was right on the mark, as you can see in the test figures. To handle propellers ranging from 13 to 17" diameter indicates power and flexibility, and an excellent value for the money.

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PROPELLER TEST FIGURES

All propellers are APC

Size	Peak	Idle
13 x 9	1016	1947
14 x 8	9603	
15 x 4	10351	
15 x 6	9803	
15 x 8	8824	
16 x 4	9422	
16 x 6	8630	
16 x 8	7664	1149
17 x 6	8183	

FUN AEROBATICS

by Ed Moorman

We're RC Reporting again,
Back where a friend is a friend.
Where Flaps and I can fly
In the warm southern sky,
We're RC Reporting again.
Oh, yeah!

(Editor's Note: Please note that the publisher and editor disavow any responsibility for illness and/or stomach cramps resulting from reading the above rhymes (using the word "rhymes" very, very loosely).)

MANEUVER
OF THE MONTH
Reverse Outside Loop

Last month we discussed Inverted Flight. This month I'm going to start with the first of a series of loops, the Reverse Outside Loop. Now, I know what you're thinking already, *"Ed, why start with the 'reverse' outside loop? Why not go with the 'regular' outside loop?"* Well, actually, the Reverse Outside Loop is the easier of the two since we enter at the bottom and loop upwards. With the outside loop we start at the top and go downward. With which would you be more comfortable learning first, one that goes upward from level flight, or one that starts high with a dive toward the ground? This is why I think you'll be more comfortable learning the Reverse Outside Loop first. This is also why we discussed inverted flight last month, because the reverse outside loop starts from inverted flight. So, we do inverted flight first, then the Reverse Outside Loop which starts from inverted flight, and then, after we get comfortable doing a loop using down-elevator but going upward, we learn the harder outside loop going downward.

DESCRIPTION

A Reverse Outside Loop is an outside loop starting from inverted flight so that the plane moves upwards to begin the loop, and finishes in inverted flight.

AIRPLANE SETUP

If your plane does a nice inside loop, then make sure your down elevator movement equals the up elevator movement. If your plane has the stab on the bottom of the fuselage like a Stick, your down elevator control will be more sensitive in the down direction than in the up direction. In this case you may use a little less down. Conversely, if your stab is mounted atop the fuselage or partway up, your down elevator will be less sensitive than your up elevator. In this case, make sure you have as much or a little more down than up.

DOING THE MANEUVER
Standard Setup

1. Full power,
2. Parallel to the runway,
3. Two mistakes high.

Yes, let's get two mistakes high this time. This is a safe altitude, not up in the stratosphere, but high enough so we can point the plane downward, and then do a panic pull of full up and still clear the ground. The reverse outside loop

R/C REPORT MAGAZINE

TEACH YOURSELF AEROBATICS CARD

REVERSE OUTSIDE LOOPS

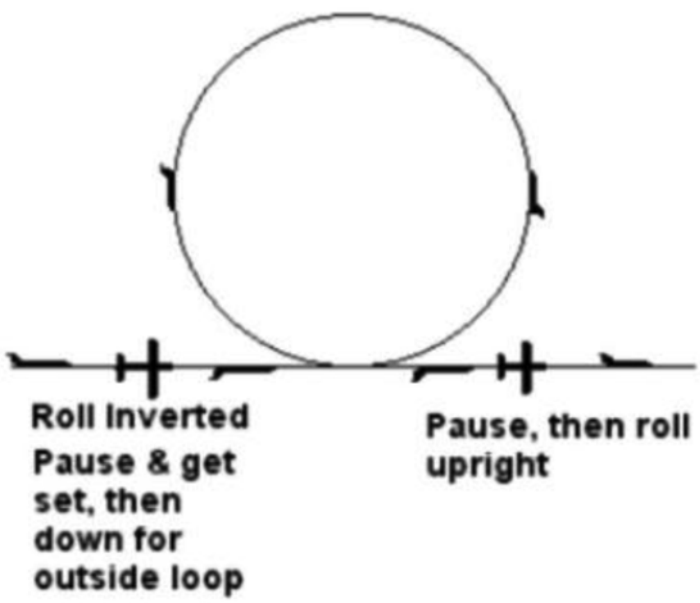
By Ed Moorman

DESCRIPTION OF THE REVERSE OUTSIDE LOOP: An outside loop starting from inverted flight so that the loop moves upwards to begin the loop and finishes up back in inverted flight

AIRPLANE SET-UP FOR DOING THE REVERSE OUTSIDE LOOP:
-Make sure your plane has about the same amount of up and down elevator - Most trainers will not do an outside loop
-The best planes are Sticks, sport planes and fun fly planes with a symmetrical or semi-symmetrical airfoil.

THE REVERSE OUTSIDE LOOP

Standard Set-up: 1. Full power, 2. Parallel to runway, 3. 2 mistakes high. Start the reverse outside loop flying into the wind.



LEARN TO FLY INVERTED FIRST: The initial step for doing the reverse outside loop is to learn to fly inverted.

Photo 1: Ed's OS .55AX powered Ultra Stick 40 with 3° of anhedral in each wing panel.

should be started flying into the wind.

WHAT TO DO

The first thing we should do is practice rolling into inverted flight, flying the length of the field inverted, and then rolling out. Do this a few times until you get you comfortable with flying inverted. Then land, refuel, and check the aerobatics card again.

After you're all set, roll inverted, pause to get the plane stabilized making sure you have neutral ailerons, then use full down elevator for your first attempt at an outside loop. This is only a test loop to see how your plane performs. After the plane finishes the loop, ease off the down elevator and roll back to upright.

Here's what can possibly happen on the test loop, and what to do to fix it, if necessary:

1. The plane went up but never got over the top of the loop: Either you don't have enough lift or enough down elevator. Try adding mote down elevator by moving the clevis closer inward at the elevator control horn, or outward at the servo arm (sing a longer servo arm if necessary). This will give you more down elevator authority.

2. Your plane rolled off to one side and you had to recover before finishing the loop: There are three things that could cause this.

A. If you're trying a reverse outside loop with a high wing

NOW FOR THE LOOP

1. Roll inverted, add a little down
2. Pause to stabilize the plane inverted.
3. Check wings level.
4. Use down elevator to fly around the loop.
5. After the loop in complete, release the down elevator and roll out.

MAKING CORRECTIONS

1. Remember, the ailerons DO NOT reverse when you are inverted.
2. Make your corrections when the plane is in the bottom half of the loop.

–Just after you start, make a quick aileron correction.
–Once you start down the back side, just after passing vertical, make another aileron correction.

PROBLEMS AND SOLUTIONS

–Your plane went around an outside loop about the same size as your inside loops. This is good. Don't touch a thing.
–The plane went up, but never got over the top. Try getting some more down elevator by moving the clevice to a hole closer in at the elevator or further out at the servo.
–This can also happen if you are flying a plane with a flat bottom airfoil.
– Your plane rolled off to one side and you had to recover before finishing the loop. This is common when trying an outside loop with a high wing plane with dihedral. The dihedral will try to roll you upright.
–Not having the wings level and the ailerons neutral when you start can also cause a roll out.
–Your plane zipped around the outside really fast and tight. This is good because you can ease off the down and still have some reserve for emergencies, but it doesn't give you much time for corrections.
–Your plane snapped out of the outside loop attempt. You have too much down causing your plane to roll off into a snap roll. Reduce the amount of down elevator.

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trainer, the dihedral will tend to make the plane roll upright. Outside loops are always more difficult with this type of plane. You may recall an earlier discussion about using anhedral in high wing planes. This will make your plane fly more like a low wing plane. Anhedral works especially well in outside loops, making them easier to keep on track. Virtually all my Sticks have anhedral (see **Photo 1** on previous page.).

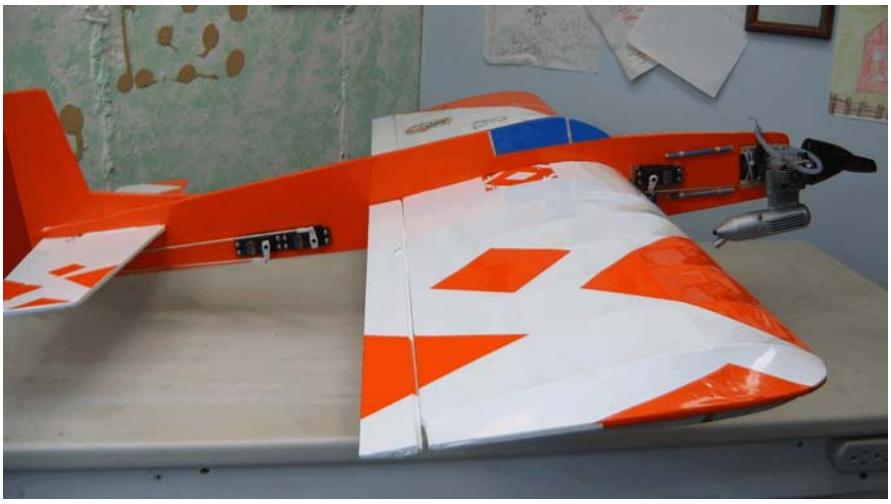
B. You might not have had the wings level or the ailerons centered when you began the loop. If you had the ailerons off-center or the wing wasn't level, the plane will roll. You need to concentrate on rolling inverted, get it level, releasing the aileron stick, and then just pushing the elevator stick forward. Maybe you can try pushing it with just your thumb.

C. Third, the roll out may have caused a snap roll. In this case, you could have too much down control, causing the wing to stall and roll off into a snap. The cure for this is to *reduce* the amount of down elevator. If your plane is snap rolling out of an outside loop, let's correct that now, because next month we'll be discussing the *regular* outside loop which goes down at the start. You do not want to put in full down elevator and see your plane enter a high speed inverted snap and spin going straight for the ground. Reduce the down elevator movement and keep at it until you can get the plane to do the outside loop at full down control.

3. Your plane completed the outside loop about the same size as your inside loops. Since this is what we're looking for, don't touch a thing except to practice more.

4. Your plane went around the outside loop really fast and tight. This is good because now you can ease off the down elevator and still have some in reserve for emergencies. I like my planes set up this way. But it's also bad since you're probably nervous doing outside loops at this point, and the loop is so fast it's hard to make any corrections before it's over. Trust me, sooner or later, you'll want to slow down and make big outsides and need to make corrections during the maneuver.

As you can see, there are a number of bad things that can happen here, so it may take you



Photos 2 (above) & 3 (below): Frank DeMaria's O.S. .40LA powered "Dart Cart" profile is an oldie but a goodie. The plans were published in a mid-70's issue of "R/C Modeler". Just by looking at the fin and rudder you can almost tell that it's a Joe Bridi design. The tail looks a lot like a Kaos, but the Dart Cart has a rectangular wing plan form, instead of the Kaos' tapered wing. The airfoil, however, is a nice, thick, symmetrical Kaos type. I saw a Dart Cart in late 1970 right after I bought my first R/C radio. I had flown profile control line planes, but had never even seen an R/C profile until then. That one had a K&B .40 for power and would really do some lively maneuvers. Frank lives up there in snow country, though, so it hadn't been flown when he sent me these pictures. I'll be waiting to hear how the test flight went.

several flights to get your plane rigged or trimmed correctly for good outside loops. You want to do this now, though, because the Reverse Outside Loop is the easiest and safest outside loop. Later when we attempt more difficult outside maneuvers, you'll know what to expect from your plane. Believe me, you don't want your plane to snap while inverted when you don't know it's coming.

Here's the sequence again:

1. Standard setup, into the wind, two mistakes high.
2. Roll inverted, pause to get the plane stabilized and level.
3. Ease in the down elevator for the loop.
4. Once the loop is complete, release the down elevator and roll back to upright.

MAKING CORRECTIONS

Once you can do a Reverse Outside Loop, you need to open it up larger and fly around making a few aileron corrections along the way. Here are two rules for making aileron corrections in an outside loop:

First, even though you're inverted, the ailerons do not reverse, so the roll works as normal. Only the elevator and rudder controls are reversed.

Second, make your corrections on the bottom. Just after you begin the inverted climb, check the wing and make a small correction if necessary. During the upper part of the loop, just fly the elevator, easing off the down a little as you come over the top, and adding a little back in as you approach a straight down attitude. As you get close to leveling off, check your wing again. If one wing is down, make a small correction.

Got it? Good. Now let's go out and practice, practice, practice, and have fun doing it.

FEATURE OF THE MONTH
More Seaplanes

This month I have more to add to last month's feature on seaplanes.

The Rascal 40 ARF is an excellent kit. The two-piece wing is joined with an aluminum bar and an anti-rotation pin. There's a dowel in the leading edge of each wing half and a bolt holds each trailing edge onto the fuselage, so there's no need to glue the two wing panels together.

Photo 4: A Bill Evans Simitar design, this Zippity-Do-Dah was built by Claude Vest, using an O.S. .46 for power. I've shown photos of Claude's planes before. He's the Midwest guru of Bill Evans designs because that's all he builds! Even though they're flying wings, they're easy to fly rock solid in flight, and not twitchy at all. I see he's using a DuBro fiberglass main landing gear. I like those too, and use them as replacements on many of my ARF's. Clause has a thread on R/C Groups if you're interested in learning more about the Bill Evans flying wings. I have one myself, a "Pole Star" with a Tower .75 engine. It was originally designed for a .46, though, so it's a rocket with that .75 in the nose, but still very stable. It also does a great inverted flat spin with an easy recovery.

Photo 5: Ed and his Bill Evans' design Pole Star flying wing. Ed uses a Tower .75 for power, making the Star very fast.

There was one change that I felt was necessary (I always change something!). The Rascal has hardwood beam mounts and a balsa cowl set for an inverted engine. I didn't want a dead engine while taxiing, and I've not had a lot of luck with engines idling well when inverted, so I changed the engine position. I wanted a side mount, but there's a bulkhead in the curved nose section between the windscreen and firewall, so I couldn't get the tank high enough without major surgery. I mounted it a 45° downward angle. This is usually enough to keep the plug from fouling, plus it gets the carb low enough for the highest tank location I could get.

After a brief phone call and a 15 minute drive to Ugo's house to use his big band saw, I was ready for the operation. Naturally, he questioned my intentions. *"Are you sure you want to saw the nose off a perfectly good airplane?"* He always says that when I saw into perfectly good airplanes, especially when I cut a perfectly good wing in half so I can rejoin it with anhedral. You wouldn't think a guy with his military background would be so squeamish, but some people just can't stand the sight of blood, and Ugo can't stand the sight of flying saw dust when he's uncertain about the surgery. *"Yes, I'm sure, Ugo,"* I replied, as I flipped the power switch on his band saw. **Photo 6** shows the Rascal's nose with the cowl and hardwood beam mounts cut off.

Flaps installed the engine, tail feathers, and radio for me. I also ordered a fiberglass, 40-size Cub cowl to cover the bare nose. Flaps painted that for me too, and then installed it (see **Photo 7**).

Photo 6 shows the Rascal nose with the cowl and hardwood beam mounts cut off.

Photo 7: The OS .70 Surpass mounted 45° down, under a fiberglass Cub cowl.

The radio gear goes into a pre-cut tray, where the receiver and battery were installed with hook and loop material.

I don't know what kind of floats we used because someone gave them to us. Flaps installed them on the Rascal and they work well, with good handling, nice take-offs, and smooth landings. He did have to install a rear mounting block for the struts, a simple piece of 1/4" plywood epoxied in the floor of the plane. He mounted the floats with the step about 3/4" behind the CG. Just think of the floats' step as the main gear on a tri-gear airplane.

The test flight went great. The wind was blowing right in my face so I took off straight out. The "Sea Rascal" jumped up on the step quickly and was in the air after just a short run. A couple of clicks of elevator trim was all it needed.

I throttled back to about 2/3 power to feel it out. It handled great, so I made a few circles and a couple of low passes before landing (or is that "watering"? No, I guess not.) (See **Photo 8**.)

Following its first flight I checked the plane out and everything seemed fine. I then waited while a few other guys flew, and then fueled up for a second flight which would include some aerobatics. The wind was picking up somewhat and getting gusty, but the plane seemed to handle it well.

The loops are good. Its rolls are a bit slow compared to a fun fly plane, but that's to be expected considering the high aspect ratio wing and small ailerons. Rolls, 4-points, Cuban-8s, Immelmanns are all easy. Inverted flight takes quite a bit of down elevator, but there was still plenty in reserve for inverted turns. Spins are fine, too.

The camera guys were wanting a low, slow, close in pass so I circled down and gave them one (see **Photo 9**). After this pass I banked steep to the left and pulled up. As soon as I got even with the top of the cypress trees that line the bank, a gust of wind and the

Photo 8: The Sea Rascal on a low fly by.

Photo 9: The Sea Rascal on a close-in, low pass.

Photo 10: The remains of my Sea Rascal. (Hats off, please.)

turbulence near the trees took the Rascal back over the trees and.. *Whump!* I know the sound of an airplane hitting that hard stuff that usually surrounds a lake. Rats and double rats! I bashed it! Don't you just hate that. *(Editor's Note: We sure do, Ed, but not as much as we do when it's our airplane.)* Here I was on only the second flight with a brand new airplane, and one that I just knew was going to be a good for a long time to come. Well, as a wise man once said, *"Every airplane has an expiration date, we just don't know what it is."* **Photo 10** shows the remains of the Sea Rascal.

I'm going to stop now while I mourn the Sea Rascal's passing (and plan its replacement). Get out there and practice those Reverse Outside Loops, and uh... don't forget the practice at least two mistakes high. Good advice, huh?

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The Webb Scale

by Gary Webb

I am humbled at being asked to write about one of my life long passions, that of building and flying scale model R/C aircraft. Since every author has his or her own slant on the subject based on their knowledge and experience, I hope I can offer something worthwhile to the readers of RC REPORT ONLINE.

My background is in the field of electronic engineering, and I have had three major careers in that field, starting with being a sales engineer working with computer peripherals and electronic test instruments. I have also taught electronic engineering at two technical institutions for a number of years. I then finished up my working career as a skilled tradesman for General Motors. The reason I'm telling you all this is that I realized I would much prefer working with my hands on a technical project than wearing a suit and tie in a design office. I *like* getting my hands dirty, and I enjoy creating and repairing things.

I currently have a private pilot's license with an instrument rating. I jokingly tell kids if they want to get high, don't do drugs, go fly! I've also been modeling for most of my 60 years here on Earth. I've been involved with just about every aspect of modeling. I began with plastic models, but something was missing. After putting them together they just sat

Beautiful Avenger seen at the 2009 Toledo R/C Expo

Mike Barbie's new T-6 Texan II

there collecting dust. Then I built some rubber-powered free-flight models, but I disliked the lack of control after launching them. Next I tried control line, but that only led to an even stronger desire for still more control. Then came radio control. To fully control a model airplane remotely was only a dream when I was a child, but suddenly it was real, so I happily joined the fray.

I have since delved into many different aspects of R/C,

Mike Barbie's new T-6 Texan II

Air Wild's new 87" Mustang

to include cars, boats, jet aircraft, scale, and aerobatic planes and helicopters. I've also been building professionally for over 25 years now.

R/C modeling even gave me the opportunity to get my private pilot's license! I had always thought about learning to fly, but I really had no idea how to go about it. Then while I was teaching a new member of our club to fly, I told him the only problem with R/C was that the plane had all the fun while we were stuck on the ground. He suggested that I might enjoy full-scale flying, and revealed that he was a licensed instructor. He also had a friend who would allow us to use his plane. So, as you can see, R/C has been good to me.

My main love throughout my modeling adventures, however, has always been scale models. I've enjoyed trying to fly them in a scale manner, and trying to share the model with someone who flew the full scale plane. To me there is no better compliment than, after landing a model, having someone come up and say, "I thought I was watching a full scale plane fly!" To that goal I have spent many years at Oshkosh and many other air shows watching how the real aircraft look in flight. I also watch flights on TV and on the internet.

I have competed in scale contests, of course, but I eventually discovered that I make a better judge than a contestant. I get a little too competitive and serious when competing, which often leads to too much stress instead of fun. I've also flown with the Buckeye Aero Squadron, an AMA show team, for many years, performing at a lot of large and small air shows. The Buckeye Aero Squadron still starts the Dayton, OH, Air Show, with a flying demonstration and a static display under a tent to promote the hobby.

Now retired, my second home, when I'm not at the local flying field of the Upper Valley Fun Flyers of Piqua, OH, is the National Museum of the United States Air Force. I live within twenty minutes of the museum, which affords me the opportunity of being a volunteer there. The museum is a great place for documenting my favorite aircraft from WWII.

I, along with Jim Martin, a close friend for many years and the AMA district associate VP here in Southern Ohio, have been a scale static and flight judge for the Masters, NATS, FAI contests, and now flight judge for the last few years at the very prestigious scale invitational, Top Gun. I feel that a scale flight judge should have a lot of experience around a wide

Your author sitting in a Tuskegee Airmen Mustang

array of different aircraft, and to be knowledgeable of their flight characteristics as well as their construction details. This helps one when judging for realism and performance. No judge can know every aircraft inside and out, but the more experience they have with many different types of aircraft, the better and more consistent judge they will be.

I've also been known to say, *"If it goes fast and makes a lot of noise, I'm interested!"* Growing up in the muscle car era of the 60's, I naturally owned some. I also share Gordon's passion for motorcycles, and sports cars were another big part of my early years.

But enough about me for now. Some of you have probably nodded off already, or have skipped to the next column or article. But if you're truly passionate about scale models, then I hope you're still here.

Scale R/C aeromodeling can open many doors to meeting exciting people that you may not have never met otherwise. This has happened to me many times over the years. There have been many articles written on how to document, design, build, cover, glass, detail, finish, and paint scale models. I guess just about every subject has been covered at some time or other, so what we need to establish here now is just what you scale guys want to read about.

From a scale judge's viewpoint I'm going to try and help you understand what is necessary to succeed in scale competition, and help you have a more satisfying experience in building scale models, whether for competition or just personal satisfaction. The owner of a truly fantastic Avenger on display at Toledo this year is one of those who does not compete. He builds strictly for the personal challenge and satisfaction. Like him, though, most of us want to show our completed

models to other modelers for peer approval, and to get feedback that may be beneficial in future efforts.

So, first I'm going to be the "bad example", so *you* can do the exact opposite of what I did! My first scale R/C model was built from a Spitfire kit, and covered with MonoKote in a finishing scheme of my own liking, made up from several Spitfire photos seen in a book. Then I took it to a local contest. When asked for my documentation, I replied that I didn't need any documentation since anybody could tell that it was a Spitfire!

Well, it just all went downhill from there. I flew the plane like a pattern plane, putting 10-20 G's on the plane every time I did a maneuver, which would probably have crushed a real pilot in his seat! Best of all, I flew it really really fast to impress the judges. And can you imagine what happened? Those stupid judges had the audacity to give me very poor scores! Man, those guys didn't know anything! I quickly adopted the attitude that newcomers didn't have a chance since all the well known pilots wore halos and always won! None of it was my fault, of course. I had a cool looking model and I flew it fast and furious. What more could they possibly want?

But I persisted, and I learned, and I got better. I eventually learned enough to offer you this advice: Find yourself a *mentor!* If no one in your club is into scale modeling to the extent you want, then learn what you can, and then start going to scale contests, make some friends, and find someone willing to help you. Now this doesn't mean you should bug them while they're assembling their plane, adjusting it prior to a flight, or during a flight. But I've found that most scale competitors are very approachable and more than willing to help. I've even seen competitors help modelers who go on to score higher than they do! Even that is a source of pride.

A good mentor can show and tell you how to assemble your documentation before building the model, and give you valuable advice based on *your* building and flying experience and ability, on choosing your first scale subject. They can also help you choose your flight maneuvers, to stay within your capabilities and those of your model. Then they can watch you fly, and help you learn to make each maneuver look as realistic as possible.

Your mentor can help you understand the rules so you'll know beforehand what is expected of you. You do know that there are rules, right? Every event, be it the Masters, Top Gun, NATS, FAI., etc., have their own set of rules, and some are very different pertaining to how the static scores and flight scores are computed and totaled.

Right now you're probably wondering why anyone would be willing to do all that for you? Well, it's often simply because someone did it for them earlier. I've personally helped many new scale modelers, as a form of pay back to my mentor. In fact, it was my mentor who suggested doing the Tuskegee Airmen scheme for my first big Mustang, and many of you know how *that* turned out. One of my Mustangs will be on a parade float again this Memorial Day in honor of these brave pilots. *(Editor's Note: Gary and his 104" span, 36 lb. Mustang appeared on the January 2002 cover of "R/C REPORT" magazine, along with Mr. Clifford Brown, an original member of the Tuskegee Airmen.)*

Here are just a couple of examples of scale mentoring that I've witnessed. Most of you have heard or know of Mike Barbie, who has competed at the upper level of scale for many years. Most know him for his beautiful yellow Waco, or his huge Stearman. Well, Mike has taken John Boyco under his wing for the last few years, helping him polish his building skills, and improving his flight realism. John has been flying a large 1/3 scale Pitts (a very hard subject to do in scale, due to its difficulty to take off and land in cross winds), and has come up through the ranks to become a force to be reckoned with. John won at the NATS and the amateur side of the Pro-Am at Top Gun last year. He told me recently that he's now building a

new plane with which to compete in the *expert* class! I also know John is eternally grateful for all the help Mike has given him, so I'm sure that he'll one day become a fine mentor as well.

Everyone probably knows of Frank Noll, Jr., who's now head of Team Futaba at Hobbico. Frank has been flying giant aerobatic planes for as long as I've known him (let's just say "many years"), and he competed in pattern before that, and was very successful there as well. Frank, however, loves pushing the envelope and trying new maneuvers. He got so good at it that clubs began inviting him to their fly-ins just to fly demos.

Now, I've seen Frank stand out on the flight line all day flying other modeler's planes, just to help them trim their planes correctly, and to offer advice on how to improve their flying skills. He often had no time left to fly his own plane, except for the noon show. And Frank didn't fly just aerobatic planes, he also flew scale models to help their owners get them trimmed as well, tirelessly offering tips and advice throughout the day. Frank, in fact, has helped me trim *my* scale birds more than once, and his assistance was always helpful and appreciated.

And these are just two of many examples of well known competitors who have taken the time to share what they have learned, so that others may enjoy this great hobby and sport. Greg Hahn, another widely known scale competitor, helped nurture a scale group in the Muncie area, and is always approachable to answer questions from modelers indicating a keen interest in scale. It's just his way of saying thank you to *his* mentors, and giving back to the sport he dearly loves.

Speaking of great mentors, the man known as "Mr. Scale", Dave Platt, has taken the time to produce a set of CD's covering the "Black Art of Scale". Dave is a true master of weathering, and will gladly teach you all he knows about building, detailing, cockpits, and painting techniques that he's used to complete his many award winning models. I have my own set, so " Thanks, Dave", for taking the time to share your great wealth of knowledge with us mortals.

Now a word to you scale judges out there. One thing that used to really frustrate me at a scale contests was getting a poor score without any notes in the remarks column as to why. Jim Martin and I vowed that we would always note in the comments section why we scored the way we did, so the pilot will have a better idea how to improve those scores next time. We've also been known to put in some accolades when the competitor does something particularly well (those "10" scores are hard to come by!). I do this because if someone comes to me after the round and asks what caused a down grade on one of their flights, I may not be able to recall their flight after a long day of judging so many flights. So, judges, please leave comments, good and bad, so the competitors know why they earned a particular score. For them, every event is still a learning process. Scale competition is all about building a truly accurate scale model, and then flying it in a true scale manner.

What is "Flying Scale"?

To me this means replicating a flight routine to emulate a particular full scale aircraft. First you have to know your subject's capabilities (speed, maneuverability, and purpose; civilian transport, fighter, bomber, aerobatic, etc.). Normally there are two general categories into which all airplanes fall, aerobatic and non-aerobatic. The Masters rules consider an airplane non-aerobatic when it is rated not to exceed 60° bank angles and 30° pitch angles. So if you're flying a Cessna 182 and doing 90° turns and/or 70-80° climbs, expect to be down graded.

Here's something taken directly from the Top Gun Rule Book:

"REALISM: The size or the aerobatic maneuvers performed by a contestant should reflect the capabilities of the aircraft modeled. For example, it would be expected that a loop

preformed by a J-3 Cub be smaller in diameter than one performed by a P-51 Mustang if both were modeled to the same scale. The speed at which maneuvers are performed also must reflect the capabilities of the prototype.

"Consideration should be given in all aerobatic maneuvers to the forces that would be exerted on the full-scale counterpart. Exceedingly small or tight maneuvers with unnecessary high rates or roll, pitch, or yaw do not simulate the performance of the majority of full--scale aircraft, and should be downgraded accordingly.

"Finally, the contestant should acknowledge that the smoothness or gracefulness of the flight presentation will have a LARGE IMPACT on its realism. The judge should consider himself to be a passenger in the model and assess these maneuvers in terms of the effect they would have on his well being."

Starting to get the picture? I have seen pilots fly their civilian scale planes like pattern planes, pulling up into 9-10 G pull ups or 90° banks and 70° climb outs on take-off.

It's important to have a competent caller assist you while flying your maneuvers during a round. Their job is to let you know what the next maneuver in your routine is, and to keep a visual look-out to keep you from having a mid-air with another model. Yes, there may be up to four aircraft in the air while you're flying. And although I have never seen a midair at any contest I've judged, it has happened.

If your caller gets your maneuvers out of sequence, you will be given zeros for the out-of-sequence maneuvers. I *have* seen *this* happen, and it destroyed an excellent round for a really good pilot.

Also, while discussing the caller's responsibilities, it is *not* their job to judge the maneuver. I've heard callers tell the judges that a certain maneuver was certainly a "10" and that the judge would be unfair to give the pilot anything less. This is both distracting to the judges and unproductive for the pilot. Callers should stay focused on the task at hand, looking out for their pilot and other aircraft.

Let's go through a scale flight now, beginning with the first maneuver, the Takeoff. My flight instructor once told me that if the centerline of the runway was not important they wouldn't have bothered to paint one on the runway. Many of us fly off grass fields, where we rarely practice lining up on the centerline. And then we go to a contest, which is normally flown off a hard surface *with* a painted center line. (Many contests do offer a grass strip for WWI type aircraft with tail skids to use.)

Once you start taxiing onto the runway you are being judged for realism until engine shut down after the flight. Taxi out to the center of the runway in a pro-typical manner for your aircraft. Tail wheel aircraft normally use S-turns while taxing so the pilot can see around the nose. Line the model up with the centerline, and then apply full throttle so you can zoom straight up from the runway.... NOT!! Hey, you're not flying a sport plane now, but a scale rendition of a full scale aircraft. Apply power gradually unless you're flying a turbine aircraft, and allow the plane to accelerate to flying speed, staying on the centerline of the runway for maximum points for the takeoff maneuver. Not many full scale aircraft pull up into a high angle of attack on takeoff, other than highly aerobatic types and high-powered jets. Most will fly off the runway in a 5-10° pitch up. Heavy war birds normally lumber into the air as the gear is retracted, and as airspeed increases they start their climbing turn away from the runway. Have the landing gear come up before you make your first turn away from the flight line.

The final maneuver, the landing, is done flying a pro-typical flight pattern to the runway. Lining up on the centerline and touching down on it, and keeping the aircraft on the centerline until you have come to a complete stop or slow enough to make a realistic turn. Even after you call the landing complete, you will still be judged on realism as you taxi back and shut down, *unless* you are told in advance to turn off the runway at the end and have your caller retrieve

your plane. At no time, once you have commenced your taxi, are you to cross the dead line which is a line normally in line with the judges' side of the runway, extending out to infinity on both sides. This is mainly for safety reasons.

Now let's say you just landed, you have all the wheels on the ground, and are below flying speed. This is when you will call your landing complete. If you do not call it complete, and your tail wheel comes loose or a strong cross wind pushes your aircraft off the runway (crossing the dead line), you will be penalized because you did not complete the landing maneuver, all because you didn't call it complete. Here again, check the rule books for the contests you enter to see when the landing is complete, and be sure to call it. I've seen pilots land, slow down, and then pull off the runway without calling their landing complete, and get down graded for crossing the dead line.

All maneuvers are to be flown parallel with the runway opposite the judges. Keep your maneuvers far enough out so as not to cause the judges to crane their necks just to see that big loop you're doing. Maneuvers should be centered in front of the judges too, unless you tell the judges beforehand. For example, a stall turn is better viewed from an off-set angle to the side. You do not have to touch down right in front of the judges for maximum landing points, but don't land 400' before or after the judges, either. If the runway is short you'll need to touch down before the mid-point of its length. And remember to keep it on the centerline for max points.

You'll find that practicing precision will improve your flying skills. In fact, you may even notice that many of the top ranked scale competitors were at one time pattern contest fliers. Terry Niche and Jeff Foley come quickly to mind. Terry has won more scale contests than anyone I know, and he too is one of the most approachable competitors, and is a true ambassador to our hobby/sport. I feel it a privilege to call him a friend. To watch him fly is simply awesome. He performs his maneuvers flawlessly, and in a truly realistic scale manner.

Flying any scale model in a realistic manner requires deft use of the rudder. I see a lot of sport pilots who think the rudder is only for taxiing. When I instruct beginners, I often disconnect the ailerons and have them fly the plane with rudder and elevator only to get them used to using the rudder during the flight. I do this after they have soloed, of course, and after they have developed a good feel for their airplane. You might want to try this with one of your trusty sport planes. You'll be a stronger scale competitor when you know how and when to use the rudder, just as full scale pilots do.

If you like, send me your questions concerning flight maneuvers in a contest, and I'll give you my opinion from a judge's prospective.

I received the following words of advice from a grand champion who's won at almost everything, from pattern, TOC, pylon racing, and even helicopter events, including international FAI contests and the first XFC. One of the best of the best is Mr. Gordon "Chip" Hyde. He once told me that he calls ahead to find out what the prevailing winds are at the site of the contest. That way he practices the maneuvers from only one direction instead of both ways. He explained it this way: If the wind is blowing in the wrong direction, he would not be at any more of a disadvantage than anyone else. But if it were blowing in the usual direction, he would have an advantage because he had concentrated on that direction of flight.

We'll continue on this subject in future columns if I get enough feedback.

What am I currently up to? I'm presently involved in assembling three Kondor Model Products aircraft. I wanted a couple of scale planes to fly for fun and practice, but without risking my show planes. I fly off grass most of the time, and that can be hard on retracts.

The first one is a Douglas Skyraider that I'm powering with an Evolution 26GT gas engine. It also uses Kondor's retracts and scale aluminum

wheels. Guidance comes from my trusted 9ZAPWCII radio converted to 2.4 GHz.

I'm also assembling a 100" B-25 for a customer. He'll power it with a pair of new RCGF 26cc gas engines. Kondor sells these engines and they really look great. This engine has rear induction with a reed valve, and electronic ignition, for just over $200. We have run both engines with a scale 3-blade 15x8 prop, getting 7200 RPM peak, and about 2100 RPM at idle.

After running over a gallon through both of them, they're within 200 RPM of each other. Guidance will be via a new JR radio with Hitec digital servos.

The third aircraft is an 87.5" Cirrus SR22. I'll be installing a RCGF 26cc gas engine in it too. I'll mount this one on its side to keep it inside the cowl, and use a scale muffler to route the exhaust out of the bottom. This should be a fun plane to fly!

I also have a Byron Original's Staggerwing I've been building on and off for the past few years. It's been altered to have a scale outline, scale hinging, hidden switches, and the pilot side door opening along with the luggage compartment door. I've built five of these over the years (four for customers and one for myself), and they are great fliers. I also have a Byron Original's Hellcat in progress for a customer.

Now, some of you are thinking, "Those KMP kits are ARF's, and not true scale models." Well, maybe so, but there many modelers out there who haven't the time or the means to build a scale model even to the degree of many ARF's. These kits are a great starting point toward getting your feet wet in scale modeling. You can enter these models in Fun Scale and compete for prizes while learning the flying part.

In closing, I'll ask you to send photos of your projects and ideas, so that we can get a feel for what our readers want, and to show everyone what you're building and/or flying. Remember, your latest project may be another modeler's *next* project, so you may be able to help another scale modeler right now!

-Gary Webb
gcwent@woh.rr.com

Two Old Scale Guys

by Dick Watz & Bill Hurt

When Gordon announced that *"R/C REPORT"* Magazine would no longer be published after the March 09 issue, the news was pretty hard to take. I had dropped my subscriptions to all the other modeling magazines, with the exception of the one you get whether you want it or not as long as you're a member of the parent organization. I'd been writing the "Watz Scale" column for Dick during his recovery and rehabilitation period following a surgical procedure, and I found that it was fun to do.

The hardest thing about writing a column for someone else is making sure that you don't embarrass them or yourself. I was fortunate that Dick's style and mine are pretty much alike, as are our past experiences in the world of scale R/C modeling. We've compared many notes, and found that we are pretty much in agreement on virtually every issue concerning scale modeling that we've discussed so far, and that's pretty scary!

We plan to use a conversational format for this column, pretty much as if we were sitting in the shop or at the field talking to one another and to you. That's going to be a pretty good trick, of course, since we live about 1200 miles apart, but that's our plan, anyway. We talk on the phone several times a week, and we'll try to get the bugs worked out quickly.

I'll be doing the column alone this month since I got the assignment too late for us to work on it together, so you'll have to wait until next month to see how well our plan does, or does not work.

More on Wacos

There have been some new developments on the Waco scene since I last wrote about these planes. After doing a lot of research on the matter, I've discovered several items that are of great interest on these planes. Hopefully you guys won't grow tired of hearing about the Waco line, because that's where my main interest lies.

I've become convinced that no one has ever offered a true scale model of the YMF/UMF Waco. Either the wings are way out of scale in thickness and/or the shape of the tips, or the tail group is all wrong, or both! I don't know why the kit designers went so far afield, but they did. I recently came into possession of a set of drawings that appear to have come straight from the Waco Factory, and these drawings bring much to light concerning these poorly scaled problem areas. With the assistance of John Howard (the Waco Brotherhood Historian) and Terry Lamb, Sr., I'm working with one of the kit manufacturers to rectify this, so there should soon be a true scale model of these Waco aircraft, as well as another popular variant of these venerable old rag bags.

Another member of the Waco Brotherhood asked where to balance his model, since his plan did not show a recommended CG location (I hate that term). I didn't have the answer readily at hand, so I told him how to determine it himself:

First jack up the tail of the model so that the datum line (the main crutch) is dead level. Then drop a weighted plumb line from the leading edge of the top wing, and mark its location. Then do the same from the *trailing* edge of the lower wing, and mark its position. Then measure the distance between the two marks, and balance the model at about 25% of that distance behind the top wing's leading edge. I later checked the original plan that I had from Pica, and found that they had placed the CG too far to the rear. This explained several things that had always plagued those of us who have built these kits or have built from the kit's plans. These models had a marked tendency to fly

Photo 1

Photo 2

Photo 3

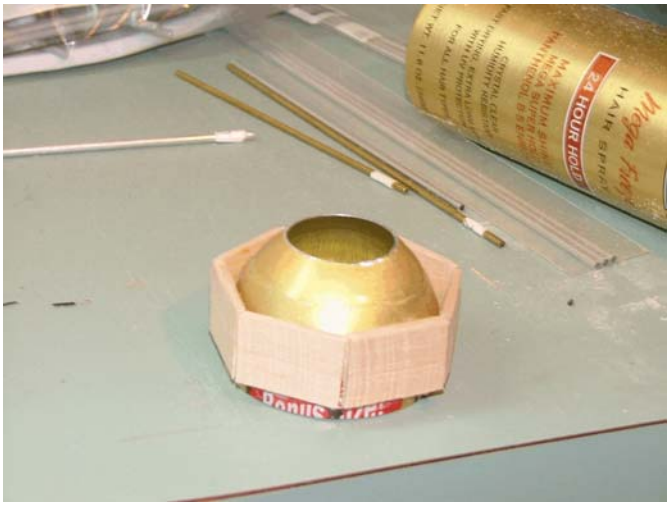

Photo 4

with the tail drooping, unless you dialed in a ton of down elevator trim. They were prone to balloon on takeoff, and had a marked propensity to tip stall on a slow approach. Now, you'd think that someone who has been flying RC for nearly 50 years would pick up on that. If you had told me that your model was experiencing these issues, I'd have told you to add nose weight, since it sounded like you had a tail heavy model. I didn't pay attention to mine either.

Have you ever needed a scale dummy engine for your latest scale build, but found that there were none available that even remotely resembled what you needed? That's where modelers building aircraft that used the Jacobs 7-cylinder radial engine find themselves. So, I decided to make my own, and started looking for objects to use in building one. I noticed that my lovely wife uses a brand of hair spray called "Freeze It." The large can had a diameter that was just about right for the crankcase, and the end of the can had a nicely rounded taper that pretty much matches the cone of the Jacobs crankcase. Then I began thinking about what to use for the cylinders and heads for this engine, since the size was important, as was the number of cylinders. I found that there's a 9-cylinder vacuum formed engine offered by one of the major kit manufacturers for their Corsair in 1/5 scale (I thought I did that pretty well without naming the company). So I purchased the scale engine and some 1/8" aluminum tubing from the local hobby dealer. I then punctured the spray can with an ice pick (Yes dear, it was an empty one… snicker), cut the end off the tapered end, and then cut the can down to the length that I needed. At the same time that I was doing this

Photo 5

Photo 6

Photo 7

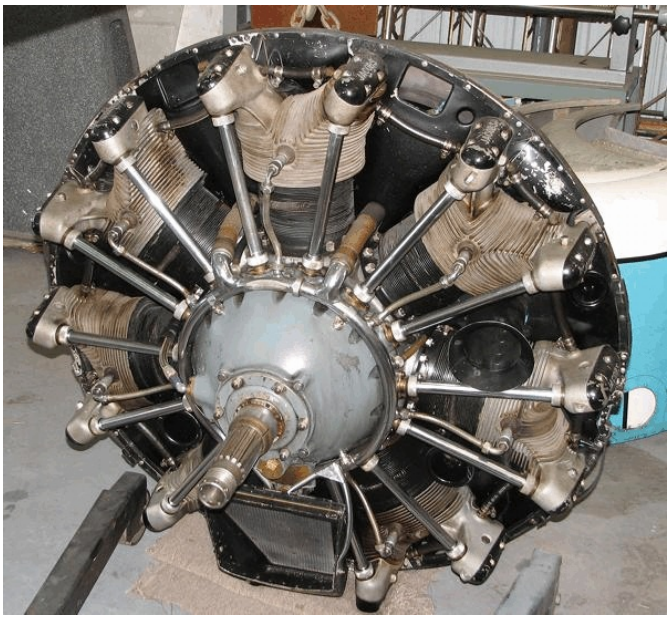

Photo 8

and posting pictures on our website, a new plans builder named Dan Hudson, of Bartow, FL, was following along and building one for his new Waco. More on Dan later.

Once the can was vented (**Photo 1**) I cut off the end (**Photo 2**) and cut the can to length I wanted (**Photo 3**). I decided to use balsa to make the pedestals for the cylinders, and came up with a dimension that would yield seven platforms of a uniform size. I used thick CA glue to adhere the balsa to the crankcase (**Photo 4**). Then I used lightweight spackle to fill the voids under the pedestals, and allowed them to cure overnight (**Photos 5 & 6**). When they were dry, I sanded them smooth, and coated them with a couple of coats of nitrate dope to seal the filler. At this point, the dummy crankcase weighed little more than an ounce. Next I cut the cylinders from the donor engine, and adhered them to the crankcase. I drilled the holes for the pushrods, and painted the crankcase, cylinders, and heads. I installed the pushrods, plug wire manifolds, plug wires, and dummy spark plugs made from 1/16" aluminum and brass tubing. Once the dummy engine was completed, it worked very well to replicate an old Jacobs 7 (**Photo 7**)

In **Photo 8** you see the full scale engine that mine was modeled to replicate. While mine still needs a little detailing, you should be able to see how you can spend a little time and effort, and come up with something that's not available any where else.

Photo 9

I earlier mentioned a young man named Dan Hudson, who was hesitant to attempt to build from plans, and especially hesitant to tackle the Waco, since this is not an easy model to build. He's well into the project now, however, and **Photo 9** shows what his fuselage looks like as of this writing. Dan, you have no reason to apologize. That's a great looking model you're building. Good job!

Well, that's all for now, so I hope to see you back again next month.

-Dick Watz & Bill Hurt
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TOLEDO 2009

by Dick Pettit

Yes, it's time to take our annual look at the Toledo Weak Signals Expo. This year was their 55th event, and I made the trip via a commercial airliner rather than driving. I completely disregarded the fact that there would be a number of other people flying into the Detroit Airport that weekend, something about basketball or something like that. In any event, three hours after I left my house, I was in a rented car headed south for Toledo and the great R/C Expo 2009.

I'd heard that Tony Coberly had somehow managed to secure table for RC REPORT ONLINE, and I'd guessed its location to be a dark back corner of the display area. I was pleasantly surprised to find it very centrally located, and it turned out to be a near perfect spot for us.

Photo 2: I met up with Tony and Doug Burfitt on set--up afternoon as they were working out the final details, like where the business cards were, and who forgot to bring the computer mice and video cables. We worked around most of the problems, and after a delicious dinner at one of Toledo's best steak houses, we returned to our hotels, eagerly anticipating the following day and the opening of the Expo.

Photo 2

Photo 3

Photo 3: At 8:00 a.m. the following day, I took full advantage of the early admittance to the press, and stepped inside the eerily quiet and peaceful show area where I soon saw the largest display model ever shown at a Toledo Expo. There, before my ever-widening eyes, was a monster 1/10 scale model of a Saturn 5 rocket, complete with a scale Apollo 11 space capsule! Built by Steve Eves, of North Canton, OH, it was scheduled to be launched later in April from a site near Baltimore, MD, where I'm sure it will attract the attention of quite a few local inhabitants as the nine rocket motors are ignited. Who knows what will happen after the switch is thrown, but we all wish them luck in their attempt. *(Editor's Note: On April 25, 2009, the 1600 lb. rocket made a totally successful launch to an altitude of over 3000'. The launch was perfect, but the recovery went beyond perfect! The parachutes worked so well, the rocket portion of the craft was lowered so neatly and softly, it landed and remained upright, almost as if prepared for a second launch! Several related videos can be seen at www.YouTube.com. Search for "Steve Eves" and then take your pick of several videos.)*

I then took a walk around the show's main floor to see which vendors had made the trip this year, who was missing, and who the new guys might be. I was surprised at the very few empty booths, especially considering the state of the economy these days, but I got to see quite a few *new* names on many booths. Some regular attendees were missing, but not as many as I'd feared. And thank goodness the "nutty ice cream bar" vendor was there!

I continued to explore, noting the locations of vendors that I later planned to visit, and made many notes about the items I wanted to discuss. Since it was nearing 9:00 a.m. when the doors would open to the general public, I headed for the RC REPORT ONLINE booth, checked my camera and batteries, and then listened to the public address system. *"Ladies and gentlemen, it is now 9 o'clock and the 2009 Toledo Expo is officially open"*. The modeling multitude began streaming into the hall from every direction, eager to see what's new for 2009.

Photo 1

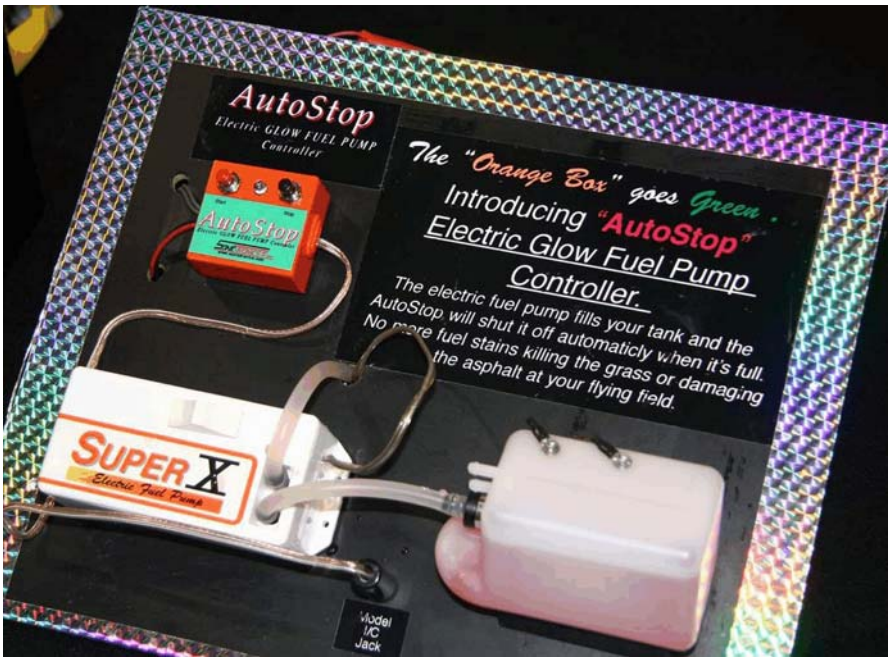

Photo 4

Here are just a few of the new and exciting items I photographed and researched for our readers. These items appear here in no particular order, and the manufacturer or distributor's email addresses will be shown in case you want more information.

First on the list is a fast-growing technology that is making itself known to modelers everywhere when battery choices are discussed. We've all heard stories about the now-famous A123 Lithium NanoPhosphate cells, but many potential buyers are skeptical of all the promises made about their performance, safety, and reliability. I spoke with the nice folks at Electrodynamics about their line of A123 products, and everything I heard made perfect sense to me. Each cell produces 3.6 volts, so a receiver battery would use two cells in series. The cells are currently rated for either 1100 mah or 2300 mah, and are half the weight of some rechargeable cells with the same capacity. Normally a *pair* of batteries connected to the receiver through two separate switches would be used in a 50cc size model. Smaller models could use a single battery with a single switch (**Photo 1**). These cells have a very low internal resistance, so there's much less internal voltage drop under severe loads. They're capable of very high discharge currents, and the only limitation is the size of the connecting wires, not the cells themselves. Also, the self-discharge rate is extremely low, losing less than 5% of their charge even after a month of sitting idle. There's also a very long cycle life, promising over 1000 cycles at a 10C discharge rate. The NanoPhosphate chemistry is relatively safe too, as it is resistant to explosion and fire, even after an accidental overcharging! According to Electrodynamics, you can fast charge the battery in only minutes with approved chargers. "Just plug it in, charge it up, and go fly", they say.

"So, what's the down-side? I mean, there must be a down-side, right? And I'll bet it's their high-dollar price tag, right?" Well, maybe not as "down" as you think. A 2-cell 2300 mah battery pre-wired with both a receiver connector and a balancing charge connector will set you back about $45. A heavy duty charge and bal-

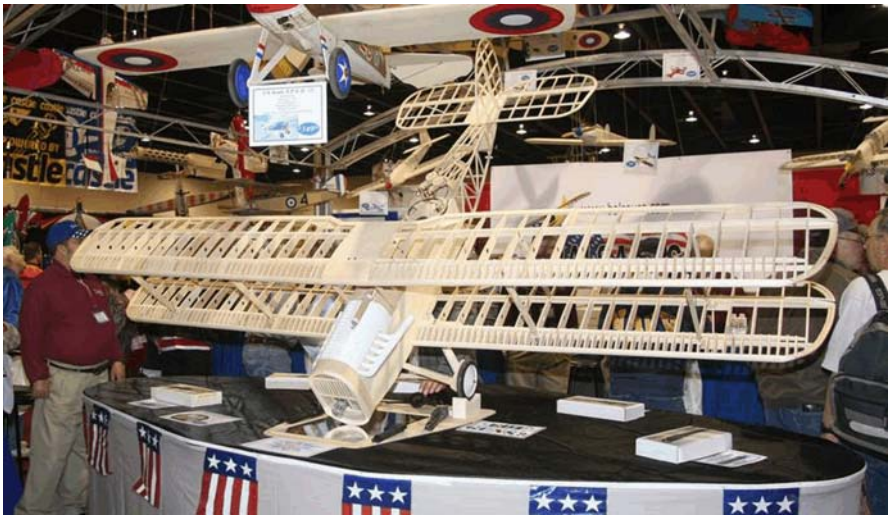

Photo 7

Photo 11

Photo 14

ancing switch will cost another $25 or so, and you may need a charger designed for A123 technology. If so, Electrodynamics has a really nice one for $80, and it will handle all sorts of different batteries. According to my calculations, that's right in line with many of the other available battery technologies available today, and the A123 line has quite a few benefits over them. I'm making plans to try a few of these A123 batteries in some of my test models this year, and I'll report on my results then. In the meantime, for more information visit...

www.electrodynam.com

Photo 4: There was a demonstration board set up at the McDaniel R/C - SonicTronics booth showing a brand new fueling system that absolutely prevents overfilling glow fuel tanks and spilling expensive fuel on the ground. It's called the "Auto Stop" system, and it uses a sensor inside the fuel tank that turns off the flow of fuel when the tank is full. I believe it's available both as a separate unit and with a SonicTronics fuel pump as a complete system. You can visit them at www.sonictronics.com for more information.

Photo 7: Right around the corner from our booth I noticed a very large model of some sort of WW1 biplane that appeared to require the total output of several balsa forests! It was one of several new kits from

Photo 15

Photo 6

Photo 39

Balsa USA, and I talked to its designer, Dave Lewis, to get more information.

It's a 1/4 scale model of a de Havilland DH-4 reconnaissance biplane that will be available as a full kit sometime later this year. With a wing span of 127", and an overall length of 89", the DH-4 should weigh in the neighborhood of 30-35 lbs. It can be powered by a 60-80cc gas engine, with a heavier engine preferred. When it comes to the covering material, you may want to find a used circus tent! The two wings alone have a top and bottom surface area totaling over 8200 sq.in. (approx. 57 sq.ft.)! The kit should be available by the time you read this, and is expected to sell for around $550. **Photo 11** gives you some idea as to the number of wing ribs, false ribs, and cap strips to be used on the production model. Dave also says that once the wings are rigged, they can be removed as a single unit, top and bottom, for easier assembly at the field.

Gee, do you think I put my name on the list to get one? Visit www.balsausa.com for more details.

At the DuBro booth, I saw this neat little setup (see **Photo 14**) that allows filling and draining a glow fuel tank while eliminating any air from entering the system, even while the engine is running! There are quite a few fuel fillers out there, but many of them leak air into the fuel lines, making

Photo 40

Photo 17

Photo 22

for a less-than-perfect flight. The DuBro E/Z Fueling Valve claims to eliminate this problem. One connection goes to the carburetor, another to the fuel tank, and the third to a port that you connect to your fuel pump. There's an air-tight cap on the fill and drain port that's said to prevent air from entering the system. The connection between the tank and the carburetor are straight through, and only when you pump fuel into or from the tank is this connection interrupted. The E/Z Fueling Valve will sell for about $9 at your local hobby shop, or call DuBro direct.

Every year the Toledo Show includes a static model display, and this year there were a great many models entered. One of the long-time award winners, Graeme Mears, entered the beautiful, scratch-built Corsair seen in **Photo 15**, featuring powered folding wings and a new Moki 5-cyl radial engine. Graeme plans to enter the model at Top Gun 2009, to be held in Lakeland, FL, on May 6-10. To see the beautiful detail found throughout this incredible model, take a look at the cockpit interior seen in **Photo 6**. And speaking of incredible detail, note the retracts and folding wing mechanisms Graeme used (see **Photos 39 & 40**) designed and built by Sierra Giant Scale. Visit www.sierragiant.com for more info.

Later in the day, Tony and I had an appointment with Art

Photo 18

Photo 21

Pesche at Great Planes who showed us a number of new items, including the neat little nano-size helicopters seen in **Photo 17**. There are currently three versions. The Novus CX ($125) is a dual, counter-rotating rotor version that just about anyone can fly. The Novus FP ($160) is a fixed pitch version, and the Novus CP ($220) is a collective pitch version. Each one is ready to fly right out of the box, and they all come with a 2.4 GHz radio system with digital servos and a single cell LiPo battery complete with charger. Check them out at your local hobby dealer.

Wow! Futaba has just announced a new 10-ch FASST 2.4 GHz radio system offering pro-level features at a sport-system price! (See **Photo 22**.) This new 10CG has a backlit LCD screen with large letters (I personally need that!) and more electronic mixes than the law should allow! There's no module sticking out the back, and the antenna is up on top of the case. It includes 15 model memories, assignable switches, a servo monitor display, and several other new and exciting features normally found only on more expensive radio systems. The 10CG will cost you about $600 for the transmitter, receiver, batteries, and a charger.

On a table near the Futaba radios sat the beautiful Top Flite Cessna 182 ARF seen in **Photo 18**. I built one of these as a kit some years ago, and was very impressed at its flying

Photo 19

Photo 20

Photo 25

abilities. This Gold Edition Cessna 182 ARF has an IMAA legal 81" wing span, and should weigh in the 12 lb. range. It's designed to use a .60-.91 2C or .91-1.20 4C engine or equivalent electric power. It also includes a functioning set of navigation lights and a pair of landing lights on the cowl. It's covered in Super MonoKote and even comes with a detailed interior. Look for it at your dealer's store, where it will sell for about $400. You may also be reading more about it in an upcoming issue of RC REPORT ONLINE (hint hint).

Battery technology seems to be advancing faster and faster all the time, and FlightPower batteries now feature greater cycle life and more capacity per ounce than ever before (see **Photo 21**). Their new EON series of batteries are also available through Great Planes

Tony Coberly is seen in **Photo 19** holding the small electric version of the new Matt Chapman Eagle 580 Unlimited Class aerobat. This 50" span electric features state-of-the-art construction and prefabrication, evident in the generous use of carbon fiber, fiberglass, and hand-selected woods. An ultra-light airframe and airfoil control surfaces promise precision tracking and incredible agility. The kit includes die-cut decals for replicating Matt's Embry-Riddle sponsored Eagle, or create your own custom trim scheme. The airframe will

Photo 24

Photo 26

Photo 44

cost about $130 at hobby shops, and Great Planes has the perfect electric motor, speed controller and batteries to complete the project.

Electric pattern models are starting to show up all over the place, and the new ElectriFly E-Performance Sequence 50" F3A Pattern ARF is one of the leaders (see **Photo 20**). With a six-color MonoKote trim scheme, a pre-built motor box, magnets to hold the top hatch and cowl in place, and more lightening holes than a wheel of Swiss cheese, the Sequence will be at the top of the list for electric pattern pilots. It'll be available in June, selling in the neighborhood of $200.

For more information on these or any other Great Planes products, visit them at...

www.greatplanes.com.

Back at the model display was the largest and most graceful looking cardboard box I ever saw. **Photo 25** shows a model named the "Cardboard Condor". It has a 150" wing span and is powered by four of the popular O.S. .61 2C engines. Ryan Livingston, of Marshall, MI, built it entirely from 5/32" cardboard, light plywood, and pine, all held together by fiberglass reinforced paper tape and clear polyurethane. The total takeoff weight is just over 50 lbs. His comments are "Yes, it's cardboard, and yes, it does fly."

At the other end of the spectrum was this beautifully done Jalopaplane (see **Photo**

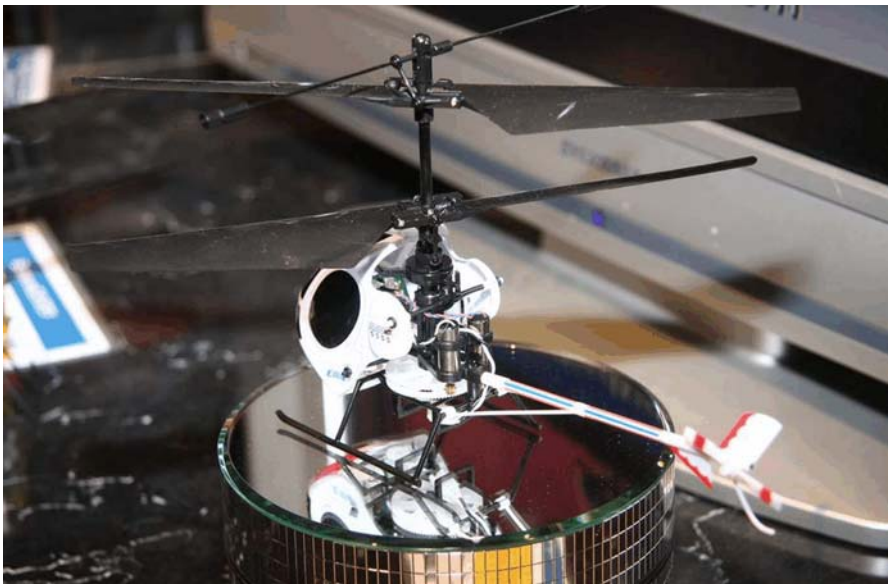

Photo 43

Photo 34

Photo 28

24), built by none other than Faye Stilley, perennial winner of the Toledo Show's "Best MonoKote Finish" award. Faye built it from plans using balsa and plywood. There is no fiberglass on this model, and even that beautiful cowl is made from wood. It's powered by a Saito 1.70 radial engine, and weighs just over 14 lbs. The 83" span model is covered entirely in Top Flite MonoKote, with no paint, decals, or stickers used anywhere on the plane. Take a close look at the details in **Photo 26**, showing what appears to be three-dimensional details, despite being flat as a board. Faye's covering technique is world renowned and well deserved. I couldn't see a seam or a gap anywhere! It looks as if he dipped the model in liquid MonoKote. Again, as in many years past, a great job!

Later in the weekend the RC Report Online group met with the nice folks from Horizon Hobby, and they promptly told us that the latest thing going was BNF, which stands for Bind-N-Fly. This means that all you need to do is bind your DSM2 transmitter to the receiver already installed in the model, charge up the battery, and go fly. One new model available this way is the tiny Sukhoi SU-26 aerobatic plane seen in **Photo 44** that includes a Spektrum AR6400 receiver and a single cell 110 mah LiPo battery. It was designed by Mike McConville, so its guaranteed to fly great! It'll sell for about $100 and will be available soon. Other BNF models will be added to the lineup in the coming months.

Photo 29

Photo 33

Photo 45

The Blade CSX seen in **Photo 43** is another Bind-N--Fly model, and with its easy to fly coaxial blades and BNF technology, the $100 helicopter is sure to be a big hit.

Hangar 9 has just released this new .60 size P-51 Mustang (see **Photo 34**) with redesigned retracts and a fully detailed covering that has rivets and panel lines built-in. The 65" span model can be powered by a .60-1.00 2C, a .91-1.25 4C, or an electric system. The model includes flaps, a nice scale spinner, and needs only standard servos for the flight surfaces, plus a pair of retract servos. It should weigh less than 10 lbs., and looks absolutely beautiful. It'll sell for around $320.

Next in line at Horizon was this large Funtana 125 (see **Photo 28**) that follows on the popular Funtana platform with another high-performance aerobatic performer. However, what makes the Funtana 125 stand out in a crowd is its new, painted trim scheme. Whereas other model schemes are limited to the appearance created with covering material, the new painting techniques give this model a modern, aggressive styling like nothing else on the market. With 1100 sq.in. of wing area and a total weight in the 8 lb. range, it should be a very good performing model. It can be powered by a .60-1.00 2C, a .91-1.25 4C, one of Saito's new 20cc gas 4C engines, or even an appropriate electric system. It has bolt-on wings and stab, large control surfaces, a removable top hatch, and fiberglass cowl and wheel pants. It also has removable

Photo 30

Photo 31

Photo 48

side-force generators like the original Funtana series of models.

One of the most popular home-built airplanes ever is the RV series of sport planes, and now Hangar 9 has made available this RV-8 with a 60" span and working flaps (see **Photo 29**). It can be powered by a .46-.60 2C, a .52-.82 4C, or a Power 46 electric system. It will be available soon, selling for about $230.

The Saratoga 40 ARF seen in **Photo 33** has an open cockpit, rounded tail surfaces, and classic styling reminiscent of aircraft from the 1930s. For sport flying fun off land or water, this 40-size sport plane also comes with float mounts so the 40-size Hangar 9 floats (HAN4015) can bolt right on. It can be powered by a .40-.52 2C, a .56-.82 4C, or a Power 46 electric system. It'll be available in late May and will sell for around $250.

Also hanging in the Horizon area was the beautiful and equally graceful looking sport model seen in **Photo 45**. The "Toledo Special" has a span of 70" and can be powered by a medium size 2C, 4C, or electric system. Selling for around $250, the Toledo Special is said to fly fast when appropriately powered, but slows to a walk when desired. I just hope that there's a larger version on the horizon. (Get it, Horizon? Oh never mind!)

Horizon also distributes the popular Seagull line of models, including the two seen in

Photo 35

Photo 30. On the left is a YAK 54 that's available now in a new color scheme, selling for about $200. On the right is a neat looking sport scale model of the British Miles Sparrowhawk, featuring a 71" wing span, and designed for a 1.20-1.60 2C, a 1.50-1.80 4C, or a 20-26cc gas engine. The Sparrowhawk sells for around $300, and a larger version, already available in Europe, may be coming later.

Photo 42

I recently reviewed one of Saito's 4C gas engines, the FG-36. Now they're offering the FG-20 seen in **Photo 31**, converted from their popular 1.25 glow engine. It's the same basic engine, but with a new carburetor and electronic ignition. The operating costs of the gas engine are said to be less than 20% of the glow engine, due to the high cost of glow fuel and the greater efficiency of the ignition system. The FG-20 sells for around $530 and is available now. For more info on these and other fine modeling products, visit...

www.horizonhobby.com

I met up with the folks at Kondor Model Products, and at one end of their booth was an assortment of gas/ignition engines that looked really familiar. The RCGF engines are now being distributed by RC Aero Products, and I reviewed their 45cc version not long ago. This time I got to see *all* their engines up close, to include the little 20cc Aerovate 20 seen in **Photo 48**. Weighing only 38 oz., they say it will turn a 16x6 prop at nearly 9200 RPM. It comes with an RCEXL ignition system, and is available in a side-carb version that sells for $220, and a rear carb version that sells for $226.. I may be using one of their larger engines on an upcoming project plane. For more details visit ...

www.zrcgf.com

Sig Mfg. Co. had the neat balancer on display seen in

Photo 41

Photo 38

Photo 36

Photo 35. Available in kit form, the Pro-Balancer not only balances models, but it can balance props too. The kit consists of laser cut plywood parts with carbon steel rods and ball bearings for long life. It looks as if it could be built in an hour to last forever. The kit sells for $40 and can be used on planes with fuselages up 11" wide, and props of just about any length. For more information on this or other Sig products, visit...

www.sigmfg.com

The big news over at the Hitec booth was the long awaited release of their new line of 2.4 GHz radio systems. The Aurora 9, seen in **Photo 42**, features a large backlit touch screen for display and data input, and I found it to be one of the easiest to read screens I've ever seen. The programming is easy, too. First you set up your model with its basic requirements, such as dual aileron servos, dual elevator servos, retracts, and/or whatever. Then the programming allows only *those* selections to be displayed for adjustment for that model. You no longer have to fumble your way through menus that don't even relate to the model in use! up. I found this to be much easier to use, and the touch screen makes it even simpler yet. You can see in the photos that there are no dials, buttons, keys or any mechanical input devices. Everything is done using the touch screen. Initi-

Photo 37

ally, the Aurora 9 is being sold with a compatible 9-ch receiver, and possibly different sets of servos. Later there will be additional features that can be used to send data collected from your model back to the transmitter, such as engine RPM, cylinder head temperature, altitude, and maybe more. The Aurora 9 transmitter and 9-ch receiver will sell in the $400 range, and will be available later this year.

There's also an upgrade set of receivers and a module that can be plugged into the back of the popular Eclipse and Optic transmitters to convert them to 2.4 GHz. The 2.4 GHz module and a 7-ch receiver (see **Photo 41**) will run about $120, and will be available soon. For more details on this and other Hitec products, browse at...

www.hitecrcd.com

At the 2008 Toledo Expo last year, I saw a new and different type of easy to build kit plane, and this year they've expanded the line to include a second model. Scale Pursuit Models has their "sorta-scale" P-73 Stallion kit available that uses EPP foam for the interior of the structure. Then a covering of detailed Polycarbonate skin complete with rivets and panel lines is glued over the foam to produce a good looking scale finish. The Stallion (see **Photo 38**) weighs about 18 lbs. and has a 83" span. Fixed tricycle gear will be provided, but retracts are available. It can be powered by a 1.40 2C, 1.80 4C, or a 2.4 c.i. gas engine. It will sell for about $600, and because of the foam core covered with finished details, the plane can be assembled quickly. For more info visit...

www.scalepursuit.com

Sullivan Products has reintroduced their popular 32 oz. gas-compatible fuel tank (see **Photo 36**), and this time with a set of rings to hold tie wraps of hook and loop material used to keep the tank in position. It comes with all the plumbing for a typical gas engine installation, and is available now at your local hobby shop.

Next to the gas tank was this huge engine starter! The Model S654 (see **Photo 37**) will start anything from a large gas engine to an Indy race car! Two handles are needed to keep the starter from rotating while starting, and it comes with the large Sullivan cone and insert to fit almost any spinner. It sells for $450, but is this starter won't turn your engine over, there's something wrong with that motor! See more details at...

www.sullivanproducts.com

And that was just *some* of the many neat offerings we saw this year. I had a great time, I renewed acquaintances, made some new friends, and ate too much. Considering the present state of the economy, I think the crowds were larger than expected. We certainly saw a lot of kits and other goodies heading out the doors, bound for workshops all over. Without a doubt, the 2009 Toledo Expo was another great show. As usual, I'm already looking forward to next year. Toledo is not only home to the greatest R/C modeling expo in the world, it's also a great place to eat!

-Dick Pettit
pettit@ti.com

(Editor's Note: I have no idea why Dick used this weird photo numbering sequence!)

E-flite™ EXTRA 260 3D 480

a product test report by gordon banks and tony coberly

Model.. . . . . E-flite Extra 260 3D 480
Airplane Type.. . . . . ARF Electric 3D Flyer
Manufacturer. . . . . E-flite (Made in China)
Distributor. . . . . Horizon Hobby
4105 Fieldstone Road
Champaign, IL 61822
(217)352-1913
www.horizonhobby.com
Suggested Retail Price. $209.99
Typical Street Price. $159.99
Wing Span.. . . . . Advertised: 43"
Measured: 43"
Wing Area.. . . . . Advertised: 375 sq. in.
Measured: 360.13 sq. in.
Advertised Weight. 23 to 24 oz.. w/o battery,
26-29 oz. w/battery
Airfoil. . . . . Symmetrical
Wing Structure.. Built-up balsa and plywood
Wing Joiner Method. . . . . Carbon fiber tube
Fuselage Structure. Built-up balsa & plywood
Fuselage Length. . . . . Advertised: 40"
Measured: 38.75" w/o the
plastic spinner (see text)
Pushrod Type. Short, stainless steel pushrods
Pushrods Installed. . . . . No
Hinges Included. . . . . CA-type, not installed
Recommended Controls. Ail, El, Rud, Throt (Requires a 6-ch radio for proper mixing and dual rates, with four sub-micro servos and a 40 Amp Brushless ESC)
Recommended Motor. . . Park 480 Brushless
Outrunner 1020 Kv
Motor Mount Installed. . Comes with motor)
Recommended ESC. . . . . 40 Amp Brushless
Recommended Battery. . . . . 3-cell LiPo,
1320-2100 mah
Landing Gear Installed. . . . . No
Wheels Included. . . . . 1.8" mains, 0.7" tail
Assembly Instructions. . . 33 pages (11x8.5") with many excellent photos and drawings
Hardware: Metric or SAE. . . . . Mixed
Hardware Included. . . . . White plastic 1.75" spinner, pre-painted fiberglass cowl and wheel pants, short 0.05" stainless steel pushrods, four micro EZ connectors, four plastic control horns, CA-type hinges, pre-formed aluminum landing gear strap with 1.25" 4-40 screw axles, pre-formed tail gear wire with nylon bearing, two 9"lengths of 1/2" velcro, two 2.25" lengths of 1" velcro, miscellaneous nuts, bolts, and screws, and an 8x10" sheet of manufacturer stickers.

Items Needed To Complete. Propeller, motor, ESC, battery, 6-ch radio two 18" and two 6" servo extensions, and four micro servos
Estimated Assembly Time. . . . . 4-5 hours
Estimated Skills Required. . . . . Experienced
Drilling Required. . . . . Yes
Soldering Required. . . . . Yes
Adhesives Required. . . . . CA's and epoxy
Tools Required. . . . . Standard modeling tools

COMPLETED MODEL

Finished Weight. . . . . w/o btry: 22.64 oz.
With 5.1 oz. btry: 27.74 oz.
Note: The above weights are without the supplied plastic spinner (0.18 oz.) which I was unable to use (see text).
Wing Loading w/5.1 oz. battery
. . . . . 11.09 oz./sq.ft.
Motor Used. . . . . E-flite Park 480 1020kv Brushless Outrunner (3.49 oz., $90/70)
Propeller(s) Used. . . . . APC 12x4.5E
Propshaft to Ground. . . . . 7.5" (held level)
Speed Controller Used. . . . . E-flite 40 Amp (EFLA312B, 0.88 oz., $110/85)
Battery Used. Thunder Power 2100 mah 3-cell Lipo (5.1 oz., $90/70)
Radio Used. . . Spektrum DX7 transmitter and AR6100 receiver, two 18" and two 6" servo extensions, four E-flite S75 sub-micro servos high speed, high torque. (Weight 0.28 oz., Torque 17 oz./in. @4.8V, Cost: $17/14 ea.)
Special Items. . . . . None

CHEERS - *Excellent* packaging, with numerous sub-boxes, sheet foam, and cardboard separators to protect all the parts 'n pieces; beautiful yellow, white, and purple UltraCote color scheme; super-light construction; beautiful workmanship throughout; stainless steel pushrods won't rust; nice fiberglass cowl and wheel pants; two-piece plug-in wing panels; very good flight performance.
JEERS - Vague and sometimes incomplete instructions; missing washer made the spinner unusable.

E-flite Park 480 Brushless Outrunner 1020 Kv Motor #EFLM1505
Cost: Retail $90, Street $70
Includes motor, prop adapter, mounting plate, mounting hardware, two Allen wrenches, and

three wiring connectors.
Weight: 3.49 oz.
Size: 35mm dia., 33mm case length, 4mm shaft dia.
Max Continuous current: 22 Amps
Max Burst Current: 28 Amps (15 secs)
Voltage: 7.2 to 12 volts (6-10 Ni or 2-3 Li cells)
For 20-25 oz. models
Reversible output shaft
Length of Wires: All 4"

E-flite 40 Amp Brushless ESC (#EFLA312B) with Dual BEC and Advanced Programming
Cost: Retail $71.99, Street $54.99
Warranty: One year
Size: 2x1x0.4"
Weight: 0.8 oz.
Max Continuous Current: 40 Amps with proper cooling
Voltage: 7.2 to 14.4 V (2-3 Li or 6-12 Ni cells)
BEC: Yes
Servo Capability: 2-4
Programmable Low Voltage Cut-Off , Motor Braking, Auto Motor Timing, Safe Power On mode
Wiring: 13AWG
Wiring Lengths: Motor 0",
Btry 3.75", Receiver 11.5"
Instructions: Two 3.75x7.75" cards

Building Notes

Keep in mind that this kit is not designed for or recommended to beginners, so experienced modelers can rely on their building experience to supplement the often vague and incomplete instructions. Read each step thoroughly until you understand what's to be done, and then do it even when the instructions are incomplete. You'll understand what I mean almost immediately, because the first step is installing and assembling the landing gear. Paragraph 1 says to install the gear so that they angle forward. Well, an offset landing gear may have been intended for this kit, but that isn't what mine came with. Mine is symmetrical, so there's no forward angle no matter which way you install it.

When installing the motor, the instructions specify using black washers, as if there was something special about them. After assembling the landing gear, however, I had only two black washers left, so I used four silver washers. (I'm so bold!) There were enough washers in the kit, but not as many black ones as called for.

The screws that fasten the wheel pants to the landing gear also actuate the brakes, because the screws go through the pants and right into the wheel, locking it in place. I decided to give up this unexpected feature and stacked 1/8" of 4-40 washers under the head of the screw to keep the tip away from the wheel.

When installing the prop we're told to use a 1/2" plastic washer to space the spinner out from the cowl. My kit had no such washer, so the plastic spinner couldn't be used.

Good luck hinging the elevator to the horizontal stabilizer. You see, the setup calls for the elevator to be inserted through the slot and then slid back and aside while the stab is aligned and glued in place. Then you insert the hinges and wiggle everything into place. Well, I wiggled for about 35 minutes with no success, at which time I had to walk away and go find something (else) to kill. I was tempted to abandon the CA-type hinges altogether and use a packing tape hinge! I came back later, spent another frustrating 30 minutes without success, and again left to go yell at Mina. This setup sucks swamp water! Once the inner hinge on one side is aligned and in place, the elevator doesn't want to flex enough to align the inner hinge on the other side! Breaking the elevator at this point is not desirable.

Well, I finally got the hinges installed without breaking the elevator in half, but I spent over an hour on this normally 5-min task. An angry and frustrating hour! And just to rub salt in the wound, once I got them in, I couldn't figure out why it had been so difficult in the first place! Arrrrg!

The rest of the assembly went alright. All of the parts fit well, the photos in the instructions are great (the photos, not the text!), and I feel sure that any experienced model builder can

have this thing done in three to four hours if that was their goal.

When it came time to balance the little Extra, I was concerned. A note on page 27 says that the builder can use a light-weight pull-pull cable system on the rudder if a light-weight motor and battery are used. Such notes are often an early warning to a tail-heavy model, and here I was not even using the supplied plastic spinner! Needless to say, I was very happy to see the model balance right at the suggested CG, with the motor battery at the mid-point of the battery tray. It will be very easy now to adjust the CG by simply moving the motor battery for or aft in the battery tray.

Then came setting the control surface throws. I was able to get the recommended low rate throws just fine, but the little E-flite S75 servos simply don't have the power to drive the control surfaces to their limits. I got the elevator high rate okay, but instead of 2.5" for the rudder, I could get no more than 2.25". Even worse, instead of 1.5" of aileron throw, I could get only 3/4" up and 1" down, which is little more than the recommended low rate (3/4" each way)

All in all, I'm not exactly thrilled with the E-flite Extra 260 480 at this point. I don't have a "warm fuzzy feeling" for it, but let's wait and see how it performs. I've more than once been unhappy at this point, only to wind up loving the model overall because of its great flying characteristics.

FLYING THE EXTRA 260

As usual, I grabbed the transmitter, turned everything on and checked the controls for proper movement, and then carried the model to the pilot gate. There I handed the transmitter to Tony Coberly while I ran back to get the camera. Tony waited until I got back, and then lined it up into the wind and bent the throttle stick forward.

I don't know if the little CAP 260 went even 20' before it lifted off the runway and headed for the clouds! It was immediately clear, though, that a lack of power was *not* going to be an issue! Tony took a few moments trimming the model for straight and level at high, but not full throttle, and then climbed higher to check its stall characteristics. The little CAP always rolled gently to the left when stalled, but it was pretty predictable and not at all violent. Knowing that the model would be easy to land, Tony then made the motor heat up as he began playing with the transmitter sticks.

Well I never would have believed it. Despite the less-than-full travel on high rates, Tony really made the little CAP 260 dance. At first he seemed to be flying it like a small pattern plane, with smooth and precise maneuvers. His comments indicated that it was flying very well. Then all of a sudden the poor little model began changing direction as quickly if it were being batted around by a tornado! Tony began to laugh, saying that it was very 3D capable, but he'd have used stronger servos. (The instructions do recommend stronger servos for 3D use, but I'd installed what I had, which were the servos recommended for sport flying. They're only like $14 each.)

Well, I could describe for you the maneuvers Tony flew... if I recognized them. But Tony seemed very happy flying the CAP 260 480, and even said that it was so light, the pilot could afford to devote a few more ounces to a larger battery for greater flight time. He used full throttle a lot, and the flight ended just slightly less than 10 minutes later.

Tony's notes simply say: "Very 3D capable, but needs better servos. The motor and prop are well matched for great performance. The model is light enough to use a larger battery. All in all a potent package with potential greater than the sport servos allow."

Okay, I wasn't very impressed with the kit's assembly, but the completed model performed better (much better, in fact) than I'd expected, especially considering the low-cost sport servos. It looks good in the air, too. We like it, but it's not a big favorite.

-Gordon Banks
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Tony Coberly
tony@hnsinc.net

PRODUCT TEST REPORT

Model. . . . . World Models T-34 Mentor
Airplane Type. . . . . ARF Fun Scale
Manufacturer. . . . . World Models
Distributor. . . . . Airborne Models
2403 Research Drive
Livermore, CA 94550
(925)371-0922
www.airborne-models.com
Suggested Retail Price. $166.32
Typical Street Price. $129.99
Wing Span. . . . . Advertised: 58"
Measured: 57.63"
Wing Area. . . . . Advertised: 577 sq. in.
Measured: 604.8 sq. in.
Advertised Weight. . . . . 5.0 to 5.5 lbs.
Airfoil. . . . . Semi-symmetrical
Wing Structure. . Built-up balsa and plywood
Wing Joiner Method. Plywood dihedral brace
Fuselage Structure. . . . . Built-up balsa and plywood
Fuselage Length. . . . . Advertised: 48"
Measured: 49.5"
Recommended Controls. Ail, El, Rud, Throt
Recommended Engine(s). .40-50 2C, .52 4C
Fuel Tank Included. 320cc
Wheels Included. . . . . 2" foam
Assembly Instructions. . . . . 13 pages
Covering Material. . . . . Toughlon
Hardware Included. . . . . Pushrods, clevises, and linkage connectors, landing gear and hardware for mains and nose wheel, wheel collars, screws and grommets for cowl and canopy, engine mount, spinner, two pilot figures and mounting foam, foam for receiver and battery, clear plastic cowl template, and decal sheet.

COMPLETED MODEL

Finished Weight. . . . . 5 lbs. 8 oz. (88 oz.)
Wing Loading. . . . . 20.95 oz./sq.ft.
Engine Used. . . . . O.S. .46AX (17.2 oz.)
Propeller(s) Used. . . . Master Airscrew 10x6
Propshaft to Ground. . . . . 7.5"
Fuel Tank Used. . . . . As supplied
Radio Used. . . . . Futaba 9C system with JR ST47 standard servos.

Covering/Finishing Used. . . As supplied

Special Items. . . . . Ernst Charge Receptacle, Maxx Products 3" servo extension, and a Maxx Products heavy-duty receiver switch.

CHEERS - Kit is available in red, blue, or yellow; quick and easy assembly; all parts were bagged and labeled by step; nice metal hinges installed; plane flies gently.

JEERS - Poor instructions (see text); soft balsa pushrods; wrinkles in covering.

The T-34 Mentor was designed by Walter Beech in the late 1940's. It made its maiden flight on December 2, 1948, and there were over 2300 built. The original Mentor used a piston engine that was later replaced by a turboprop engine and re-designated as the T-34C. The T-34C carries a crew of two with a maximum speed of 320 mph and a rate of climb of 1480 ft./min. It has a service ceiling of 25,000' and a range of 690 miles. The Mentor has had numerous upgrades and the T-34C is still in service today, both in the U.S. and other countries. The U.S. Navy and Marine Corp currently still use the T-34C for pilot training, but it is gradually being phased out and replaced by the single-engine turboprop Beechcraft T-6 Texan II, both here and in several other countries..

The World Models T-34 kit is what I consider to be a budget ARF kit. Most of the ARF's from World Models sell for under $150.. This is the third World Models aircraft I've owned. The first two were both Sky Raiders that met unfortunate ends, one from my clumsiness (I stepped on the tail), and the other from a wing structural failure during an inverted high-G maneuver. I immensely enjoyed the Sky Raiders, however, and am looking forward to flying the T-34.

All of the parts were individually bagged in the box, and each was labeled to the corresponding step listed in the instructions manual. I could see that the covering had several wrinkles, possibly from being in my garage over the latter part of the summer. I'm sure a little time with an iron will smooth most of them out. I removed the instructions manual and took inventory. All is good. Make sure you read the instructions several times before you begin assembly. There are *some* written instructions, but the manual reminds me of the days when I put plastic models together, because the instructions are mainly just drawings and symbols of when to add glue. There are numerous problems, and I'll try to cover them as we progress.

The ailerons are already hinged and installed, but it's still listed as Step 1. Just give the ailerons a good tug to make sure. Then remove the wing joiner and test fit it into each of the wings. I had to clean up the area on the left wing so the joiner would insert fully. I then used 30-min Z-Poxy to join the wings, and let them cure overnight. The next area, installing

the main landing gear, is a little fuzzy. Make sure you install the short end of the main landing gear into the wing. You will need the long end in order to attach the wheels. Before I installed the mains I used my grinder to provide a flat spot for the wheel collars to tighten. I also reinforced the screw holes with some thin CA to harden the surrounding wood for the landing gear straps.

When it comes time to install the horizontal stab and elevator, make sure you test fit it. I had to sand the fuselage to level the horizontal stab with the wings. The instructions show the elevator having a pin that fit into a hole in the fuselage and being retained by a single screw. I decided to use Z-Poxy instead. Also, there are three pin-holes in the elevator on one side for the elevator control horn. Make sure that you align them on the proper side of the aircraft, I didn't and had to re-drill them later. I attached the rudder and vertical stab to the fuse using epoxy.

The next step is to install the fuel tank. Here's where I ran into problems with the sequence of the instructions. It tells you to install the tank, but it doesn't mention anything about the nose wheel steering or the throttle pushrod until much later in the process. Skip ahead and install the pushrod tubes *before* you install the tank in the fuse. Trust me, this will save some headaches later. I assembled and installed the tank, retained by a piece of balsa glued behind it. I also stuffed some foam around the tank, just to keep it from touching the fuse.

When ready to install the engine mount and nose wheel assembly, I recommend that you use some epoxy thinned with alcohol to paint the firewall to fuel-proof it first, since it is not already fuel-proofed. The engine mount is straight forward. I put some Locktite on the screws to secure them as well. When I installed the nose wheel assembly it was binding too much, so I enlarged the upper hole in the engine mount to remedy the problem. Make sure you install the steering arm with the flat edge out to allow enough movement for steering. Make sure that you attach the steering arm to the pushrod, before final assembly of the nose wheel. I also put flat spots on the arm where the wheel collars would be installed. Then mark and drill the engine mounting holes and install the motor.

World Models has provided a two-piece clear plastic cowl template and dedicated an entire page in the instruction manual to explain how to use it to mark and cut the cowling. I followed their instructions and had no problems at all.

Next you're told to install the pushrod and control horns for the rudder. Nothing is said on how to assemble the pushrods. You're given a balsa dowel that's drilled 1-1/2" down from both ends with a groove cut from the hole to the end of the dowel, a 2-56 threaded rod, a 2-56 plain rod,

and two pieces of heat shrink tubing. The same items are also provided for the elevator pushrod. Take a balsa dowel, the threaded rod, and slide a piece of heat shrink onto the dowel. Then insert the bent end of the threaded rod into the hole and groove in the balsa dowel, and slide the heat shrink over it. Now heat the heat shrink tubing to hold everything in place. Assemble the other end using the plain rod. The elevator pushrod is assembled the same way. I recommend adding some CA glue or epoxy in the slot in the balsa pushrod for a little structural insurance.

Be sure to use the 22mm control horn for the rudder. Now you need to cut open the exit hole in the fuse for the pushrod. I pushed a 2-56 rod inserted through the exit hole until I could see it in the fuse. Using a piece of heat shrink, I attached it to the threaded rod end of the newly assembled pushrod. Now carefully pull on the 2-56 rod and slowly feed the rod into the fuse until it exits the fuse. Now you can remove the heat shrink and install the rudder clevis. You can use the same method to install the elevator pushrod. The clearance for the elevator pushrod is very minimal, and I broke one on the first attempt without using the 2-56 rod method.

Next you can install the servos in the servo tray, but before doing this do a trial fit in the aircraft first. I needed to trim the servo tray for proper fit. I really enjoyed installing the servos this way. Once you have the servos installed into the tray, epoxy the tray in place in the fuse. The servo tray retaining angle braces are glued in using epoxy. Once the epoxy on the tray has cured, you can hook up the controls to the servos. The elevator and rudder are connected to the servos using a 90° bend and a plastic retainer. The nose wheel and throttle pushrods are connected using World Model's version of an EZ-connector. When connecting the nose wheel pushrod, make sure to connect it on the same side of the servo arm where the rudder pushrod is located. The instructions show it on the opposite side, but this will result in reversed steering. The kit includes a foam block for the battery and receiver to slide into, and that assembly slides into the fuse just behind the fuel tank. This makes for a very neat radio installation.

I then installed the pilots, the canopy, and the wing. I double-checked the alignment of the wing and tail surfaces, and set the control throws to the recommended settings. Then I put the model on my Great Planes Balance Machine, and found it just a little nose heavy. It needed only six grams of weight at the tail to balance perfectly level. I decided to fly it without adding the extra weight, however.

FLYING

I made plans to meet Tony Coberly, our test pilot guru, at our local field for the first flights on the T-34. I assembled the plane, took the ground photos, and fueled up for the first test flight. After a quick radio range check, Tony taxied the plane to the far end of the runway while I got into position to take photos. He advanced the throttle slowly, and the T-34 accelerated briskly, leaving the ground in short order. After turning around and heading back downwind, only two clicks of down and left trim were needed for straight and level hands-off flight.

Tony tried a few simple loops, rolls, and a stall turn. It was pretty windy that day, but the T-34 handled the rough air well. Then Tony pulled the throttle back and tested the stall characteristics. The model slowed and then gently fell off to one side or the other before it resumed flying. He then put the aircraft through a few more maneuvers just for the camera.

Next he decided to make a slow pass to test the landing characteristics. He turned into his downwind leg, and set the T-34 down perfectly.

Other than a few new wrinkles in the covering, the T-34 Mentor had no obvious problems after the first flight, even in a gusty 15 mph wind. The wind kept getting stronger, though, so we decided to continue testing at a later date.

CONCLUSION

The World Models T-34 Mentor model has great lines and graceful flying characteris-

tics. It assembles quickly and easily, and can be powered by a wide range of power plants. It doesn't need high dollar servos, and with a total weight of less than 6 lbs., the wing loading is light enough to allow slow flight without any problems. It looks great in the air and on the ground. I have to agree with Tony's comment when he said, "I like it!"

I have since gone to the World Models website and downloaded new instructions for the T-34. The model now comes prepared for dual aileron servos, and they have corrected some of the errors in the old instructions manual.

-Doug Burfitt