RCReport Online!!

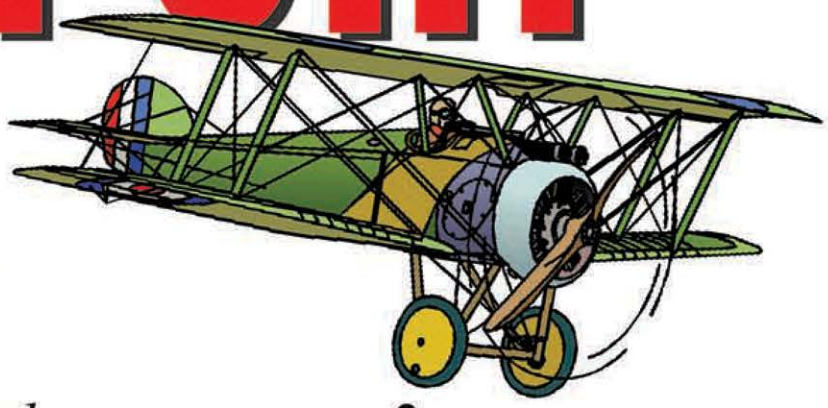
Issue #278 September 2009

WE FOUND HIM!

THE ONCE THOUGHT TO BE EXTINCT "KIT BUILDER" IS FOUND..HECK WE ACTUALLY HAVE TWO THIS MONTH!!
CAN YOU BELIEVE THE LUCK!

by jesse wall

R/C REPORT ONLINE



September 2009

lines from the editor

WOULD YOU BUY THE SAME THING AGAIN?

When shopping for an automobile, in addition to reading everything I can find on the vehicle in question (*especially "Consumer Reports"!*), I like to talk to current owners of the vehicle. If the owner has had it a while, I ask if they would buy the same vehicle again, and why. Most people say they would, but *that* answer is not very helpful. People tend to defend their buying decisions even if they've had problems. It's rare to find someone willing to acknowledge that they made a mistake. But if I do get a *"No"* from someone, then I want to know more! Still, one man's reason(s) for not liking something may be insignificant to another. When asking about computers, for example, I was once advised to avoid a certain manufacturer because, according to that person, *"DELL is too concerned about reliability, so their systems aren't as fast as some."* It turned out that I was speaking with a hardcore gamer who wanted high-speed above all else. I, on the other hand, consider reliability more important, so I was pleased.

Not surprisingly, as my grayness and waistline increase, my vehicle priorities change. I no longer have a young man's desire for high performance cars with flashy styling, that lead to gas guzzlers and high insurance rates. Now I exercise a more discriminate search for reliability, quality, reliability, value, reliability, features, reliability, resale value history, and, of course, how many model airplanes that sucker will carry! Not many folks drawing social security share my need for a vehicle that will tow a dirt bike trailer, but luckily for me, suitable aircraft carriers usually have more than enough towing capacity for a lightweight motorcycle trailer. So, I now drive the highly rated Toyota Sienna (made in Indiana). And to help prevent all those wise-cracks about me driving a soccer-mom vehicle, I removed the "I'll never

use it anyway" roof rack to give the vehicle a lower, sleeker, and more "mini-limo" look. *"Car & Driver"* magazine called the Toyota Sienna *"Lexus-like in quality and ride"*, so just for the fun of it, I replaced the Toyota name and logo on the rear door with those from a Lexus. Now I may have the only Lexus mini-van in the world! (Or is it "Toxus" or "Lexota"?). The sales manager at the local Lexus dealer is a dirt bike buddy of mine. *"Thanks, you (I've deleted his vague reference about me being born a puppy)! We really appreciate all the phone calls we're getting, asking about a car that doesn't even exist!"*

Anyway... in this same line of thought on "researching before buying", *I'm* often asked about some of *my* choices in R/C products, since I've used and been exposed to more different R/C products than the average modeler. So, somewhat like those "long term tests" seen in several car and motorcycle magazines, I've decided to offer my thoughts on some products I've been using for some time now. Please understand, however, that I am not familiar with every available product, so I'm not implying that the items I'll describe are the best in their class. I'm only offering my opinions, based on my own personal experiences.

This month I'll begin with one of the most important (and costly) pieces of equipment we R/C junkies use on a regular basis, that all important transmitter (aka, crash controller).

THE FUTABA 10C

Since I'm not really smart enough to have planned all this in advance, I got really lucky here. Thanks in part to *another* radio manufacturer, I consider the Futaba 10C to be the

1. Futaba FM & FASST RF Modules
2. Hansen Hobbies 256K CAMpac memory module
3. Standard and homemade transmitter batteries
4. The Futaba 10C transmitter

Editor's Special Mixing Control (mixes balsa with dirt)

ideal transmitter for me. (For more, in-depth details, see the printed October 2008 issue's "Futaba 10C review" and "Futaba 10C Hop-Up" articles, and November 2008's "Still More Muscle for the Futaba 10C". If necessary, send me an email for instructions on how to order back issues or photocopies of past articles.

Keep in mind that I am not a builder of complex models needing 10 or more channels. I'm merely a sport flier who rarely uses even six different functions in a model, but I do frequently use two channels for a single function, ailerons in particular. My desire for a transmitter with seven or more channels is based primarily on my passion for powerful programming features. The Futaba 10C, in fact, comes with a 14-ch receiver that I've never even used! So far I've only used the transmitter's 7-ch mode, with 5-, 6-, and 7-ch receivers, in one of its three different RF configurations, depending on which RF module I'm using.

My Three RF Modules

The Futaba 10C comes with a 2.4 GHz FASST TM-10 RF module. In its 10-ch mode it's compatible with Futaba's 8-ch R608FS and the supplied 14-ch R6014FS receivers. In its 7-ch mode it will control several 6- and 7-ch FASST receivers. (FASST = Futaba Advanced Spread Spectrum Technology.)

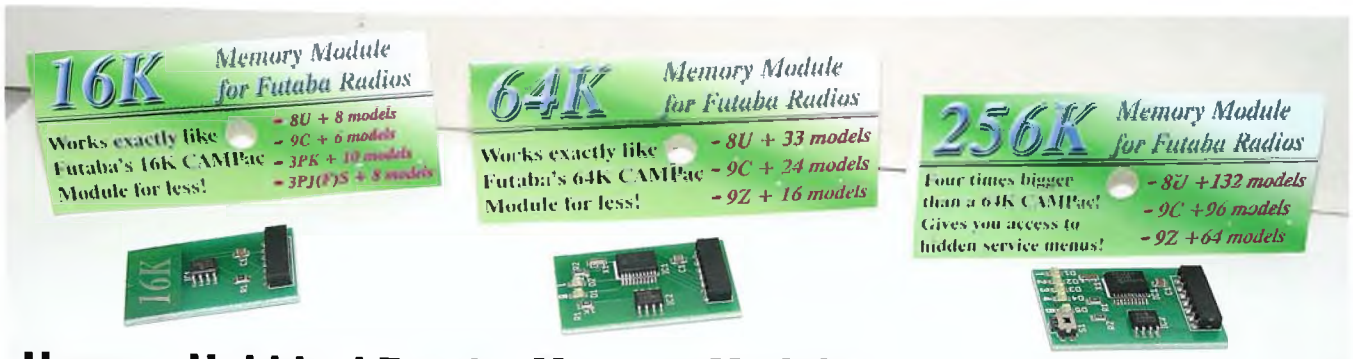
The 10C will also use Futaba's TP-FSM RF module, which is a synthesized 72 MHz module for all Futaba-compatible FM and PCM1024 receivers on frequencies 11 thru 60. (The transmitter comes with the 10-section telescoping antenna necessary for 72 MHz frequencies.) The 72 MHz RF module thus allows me to use the new, feature-packed transmitter with all my old Futaba-compatible FM receivers.

Finally, the Futaba 10C also accepts Spektrum's "Futaba Compatible" 8-ch DSM2 RF module that makes Futaba "C-type" transmitters compatible with JR and Spektrum DSM2 (but not DSM) receivers. The last time I checked, we could buy this RF module for $110, and it comes with an AR7000 7-ch DSM2 receiver that normally sells for $99 alone! And since Spektrum offers *several* fine 5-, 6-, and 7-ch DSM2 receivers for under $100 each, I consider this to be a *very* good buy!

By the way, when using either of the 2.4 GHz RF modules, the transmitter draws about 140 ma. The 72 MHz RF module draws about 290 ma.

Model Memories

The Futaba 10C has built-in memory for 15 different models, which is probably more than enough for sane people. Sadly, however, our hobby includes many pitiful and hopelessly addicted R/C junkies who have 20 or more airplanes ready to fly on any given day. Not



Hansen Hobbies' Futaba Memory Modules

being so weak and subject to such a silly addiction myself, I currently have only 18 ready-to-fly models (after having sold about 20 earlier this year). Never theless, I often worship at "Tim the Tool Man's" "More is Better" altar, so I wanted more model memory.

Well, the Futaba 10C just happens to have a slot for CAMpac memory modules (aka, memory cards). Futaba offers 16K modules for $25 a pop, each capable of storing another four model memories (that's $6.25 per memory). With enough such modules, there's no limit on how many model memories you could have, with as many as 19 in the transmitter at any given time.

Hansen Hobbies, however, offers the 16K cards for just $12 ($3 per model memory), plus they have a 64K card (16 models) for $35 ($2.19 per model memory). Plug in the 64K card and you'll have a total of 31 model memories. Surely that's enough, right?

But I ask you, would Tim the Tool Man stop there? Well of course not! Not when Hansen Hobbies also offers a 256K memory module for $65 that holds a whopping 64 model memories (now just $1 per model memory), bringing the total number of model memories in the transmitter to 79! Feel free to have even more 256K cards in your transmitter case if you're a close relative of Bill Gates.

But wait, there's more! The Hansen Hobbies 256K memory module also allows access to three hidden "service menus" in the Futaba 9C, 9CS, and 10C transmitters. These menus were intended only for service technicians however, so play around with them at your own risk. The Hansen Hobbies website and the paperwork accompanyng the 256K module have more details.

Yeah yeah yeah, I know... some transmitters hold even more model memories. In fact, the Futaba 12FG Tony Coberly uses *comes* with 30 built-in model memories. Add the optional SD memory card,however, and modelers overdue at the Betty Ford Clinic - R/C Wing can have 1,882 model memories. And just so you won't think that was a typo, I'll repeat it... 1,882 model memories. Have several cards if you like.

Anyway, you can visit...

www.hansenhobbies.com

for more details on their memory modules and several other neat and interesting products.

Transmitter Battery

The Futaba 10C's standard 700 mah NiCd battery is good for over two hours when using the 72 MHz RF module, or about *five* hours when using either of the 2.4 GHz RF modules. Once again, that should be enough, but does it really fit in with the "more is better" plan? Besides, my 10C was showing signs of jealousy for the Spektrum DX-7's ability to transmit for about 12 hours on a full charge. That 2.4 GHz transmitter too draws about 130 ma, but it comes with a whopping 1500 mah NiMH battery!

So, I replaced my 10C's 700 mah battery with a homemade 2700 mah NiMH battery. I used a Radio Shack cell holder into which I stuffed eight AA size "POWEREX" NiMH cells, which are the best NiMH cells I've ever tested (four for $15 at the local Batteries Plus store). My "many cycles" average with these cells is an outstanding 2450+ mah. Why is the

lower figure considered "outstanding"? Radio Shack's 2100 mah cells (four for $20), and Rayovac's Hybrid 2100 mah cells (four for $14) both averaged 1850 mah. Sanyo's excellent "eneloop" 2000 mah cells (four for $8 to 20) averaged 1976 mah. Although the Sanyo cells, if bought for $3 or less per cell, are the best value, the POWEREX 2700's remain the most powerful NiMH's I've found.

I also tested three different LiPo transmitter batteries (see the January 2009 printed issue). The 1500 mah LiPo from Flight Power cost $56 plus $3.00 shipping from North Carolina. The 2700 mah LiPo from FMA costs $55 plus *$9.00* shipping from Maryland. The 2620 mah battery from Hobby King cost $18 plus $6 shipping from Hong Kong.

The very best battery of the bunch was the FMA 2700, the output of which averaged about *3100 mah!* The best *value, however,* was the Hobby King 2620, which averaged slightly better than 2620, and was the only one of the three that came with both Futaba and JR transmitter connectors. The Flight Power 1500 mah LiPo averaged around 1600 mah.

I chose to use my home-made POWEREX NiMH battery for charging ease. But then I carry the Hobby King 2620 in my transmitter case for backup, since it will plug into my Futaba 10C *or* my Spektrum DX-7.

Final Result: "Super 10C"

By choosing the appropriate RF module, my Futaba 10C transmitter now works with all Futaba-compatible PCM1024 and FM receivers on channels 10 thru 60, most Futaba 2.4 GHz FASST receivers, and all JR-Spektrum DSM2 receivers. It has on-board memory for 79 model memories, and unlimited model memory storage via extra CAMpac modules. And with its 2400 mah "measured" battery capacity, it will operate for over 18 hours with either of my 2.4 GHz RF modules, or a little over eight hours if using the 72 MHz RF module. That's plenty, right?

Including a nice neck strap, a slick aluminum transmitter case, and the spare battery, I have very close to $1000 invested in my Futaba 10C "Super Version" radio (including two receivers but no servos). This is the first "over $500" radio system I've ever owned (with intentions to keep), but it's worth it. It has nearly every programming feature I want. I'd like to have selectable "flight modes" and a couple of "virtual channels", but I've never had them on any radio I've owned anyway, so I get by without them, and so far by using only seven channels.

The Bottom Line?

The big, final question is always the same... *"Would you buy the same thing again?"*

You know, I might first take a really long look at the Futaba 12FG. It has quite a few more programming features, and it can use the same three RF Modules as the 10C, but with the added compatibility for Futaba's highly potent G3 PCM2048 receivers. It can't use CAMpac memory modules, but it can use an SD card on which it can store as many as 1,882 model memories. And that's enough memory power even for Tool Man Tim!

But reality would return when I'd see its $1000 price with only *one* RF module and receiver. Plus, those super fine PCM2048 G3 receivers sell for $340 each! So even if my ego said "Oh Yeah!", my checkbook would merely chuckle and shake its head, "Oh No!"

JR, of course, offers some equally excellent radio systems, and both Airtronics and Hitec are promising new and more powerful radios soon. But do they have the same flexibility? You see, Spektrum kinda shot themselves (and *JR*) in the foot (feet?) by offering those 2.4 GHz modules for many Futaba transmitters. Since I know of no one offering a Futaba FASST RF module for a JR or Spektrum transmitter (correct me if I'm wrong), the only way I know of to have a transmitter compatible with Futaba *and* JR/Spektrum 2.4 GHz receivers, is to have a Futaba transmitter with both types of RF modules.

So yeah. If I were to lose my Futaba 10C transmitter, I may have to sell a few toys to swing it, but I'd go for another one just like it.

SOME FAVORITE MODEL AIRPLANES

In the October 2007 issue of the printed *"R/C REPORT"* I wrote a two-part review of the Pacific Aeromodels ARF "Knockabout 46". It was in two parts because I was so pleased with the first kit, I almost immediately built a second one, converting it to electric. The first used an SK .50 ABC 2C glow engine. For the electric version I simply copied the power system used in Hangar 9's ARF 80" span Electri-Cub (E-flite Power 46 Brushless outrunner motor, a 60 Amp brushless speed controller, and a 4-cell 3850 mah LiPo battery). I'm still flying and enjoying both versions, but I fly the glow version more due to the quicker turnaround time between flights. Since my conversion did not include a quick-change battery compartment, I have to remove the wing for access to the battery.

Both models fly great, and both are capable of aerobatics that defy the flat-bottom airfoil.

I've watched one of our club's better pattern fliers do things with the Knockabout that such airplanes simply don't do, to include numerous laps around the field in knife-edge flight! Yet when it comes time to land, it shows off the trainer-like characteristics we'd expect from a 62" flat-bottom wing and a 19.55 oz./sq.ft. wing loading. The Knockabout 46 may be the most aerobatic model I've ever seen that fits so well into the "great second airplane" category. It's so easy to fly, in fact, even *I* regularly get smooth, bounce free landings and reusable propellers!

One complaint is that some of the covering material on the wing kept coming loose. Once it would no longer adhere when ironed back down, I glued it down with some thin Zap, and then covered it with some clear, self-adhesive trim material left over from another kit's decal sheet. Also, I used the optional wheel pants for the first model, but they didn't align well so they didn't look good. After removing their 3 oz., I also moved the receiver battery into the cowl, fastening it to the left side of the motor mount. This allowed removing
the 4 oz. nose weight added earlier to achieve the recommended CG point, since I'd used a pretty light engine. Together these two changes dropped 7 oz. from the model, giving it the new and lighter 19.55 oz. wing loading.

Just recently, however, I did some more experimenting with the CG, and found that I like it best when the CG is about 3/16" behind the recommended point. I lazily achieved this by adding a 3/4 oz. weight to the very tail end of the fuselage.

Anyway, I still agree with what I said in the original review, the PAM Knockabout 46 has flight performance so good, it borders on being magical!

This next one almost defies belief. The Park Zone Ready To Fly T-28 Trojan, as reviewed in the June 2008 printed magazine, is an inexpensive, electric powered, fun scale model that flies so well, we even suggested that it might be the electric RTF of the year! It astounds almost everyone! We currently have so many of this particular model in our club, some fliers have resorted to painting theirs to make it more identifiable! The same airplane is also available as a Plug 'N Play kit in which you get the complete airplane with motor, speed controller, and servos, but not the 5-ch transmitter, receiver, LiPo battery, and cell-balancing battery charger.

Park Zone RTF T-28 Trojan

The RTF version costs more, but it's a better value.

At least one local flier, who doesn't particularly like RTF's, ARF's, or even electrics for that matter, bought one and flies it regularly. We're not talking about it being a "pretty good flier". The Park Zone T-28 is a *great* flier! Before he joined *"R/C REPORT"*, Terry Dunn reviewed this model for another website, and he too felt that it was an amazingly good model. In fact, I've yet to come across *anyone* who's personally familiar with this model, who isn't also amazed by it.

We have seen a few problems with its electronics, however. At least two people have received bad servos, and at least one had a bad receiver. Horizon Hobby stands behind its products, though, so they'll replace any bad components discovered in new models.

I hate to sound like I'm stuck in a RTF rut, but here's another winner from Park Zone Models. The RTF (and Plug 'n Play version) "Radian", as reviewed in the March 2009 printed magazine, is an amazingly good sailplane! The RTF version of this two-meter, all-foam, electric powered sailplane comes assembled with everything you need; folding propeller, brushless outrunner motor, speed controller, receiver, two servos, 1300 mah 3-cell LiPo battery, and a nice, cell-balancing battery charger. The Plug 'n Play version is about $80 cheaper, but you lose more than $80 by giving up the full-range Spektrum DX5e transmitter (with batteries!), the full-range AR500 5-ch receiver, the 1300 mah LiPo battery, and the cell-balancing battery charger. Trust me, I know, because I bought some of the PNP versions, thinking I was saving money since I wouldn't be using the relatively featureless DX5e transmitter. Too late did I realize that just the fine little 5-ch receiver and 1300 mah LiPo battery cost more than I'd saved!

Anyway, we have several of *these* in our local club too, and they fly *beautifully*! With its supplied 1300 mah battery, flights of 40-45 minutes are commonplace, and 60 minute flights are not rare! I fly mine with either a 1000 mah or 1250 mah 3-cell LiPo (use 15C or better, though), and I always get flight times that exceed my "standing out in the sun looking up" comfort zone.

The transmitter's elevator trim tab can be used to make the Radian float along on light thermals (*"Is it moving at all?"*), or nosed slightly down to become much like a hot-liner (a speed sailplane). Without ailerons it doesn't roll, but it'll loop like crazy!

Park Zone RTF "Radian"

An "unintended feature" I like is that if you tape the horizontal stab in place with easily removed tape, the model can be taken apart in about a minute to fit back in its box! This protects the soft foam from dents and dings during storage and transporting.

The only negative comments so far are based on its primarily white color, which is easy to lose high in the sky. And when its sleek shape is coming right at me, it sometimes becomes invisible to these old eyes. I'm thinking about painting at least the leading edge with a brighter but contrasting color. Some pilots have already added visibility markers to the lower wing. Also, the slick foam does not like stick-on decals. To make them stay in place, I had to smear a thin film of Zap over the die-cut graphics I added.

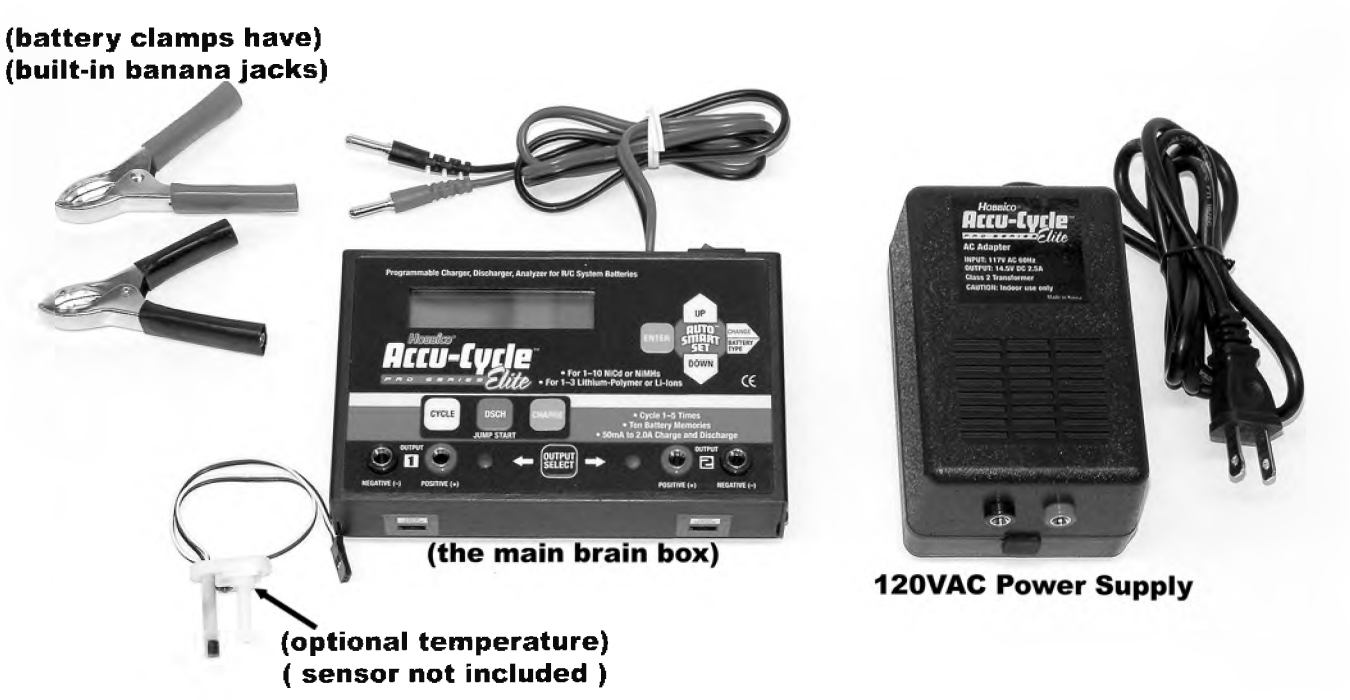
Anyway, if you like powered sailplanes, you'll love the Park Zone Radian. But even if you already have a DSM2 compatible transmitter, get the RTF version... it's a better value.

The last item I'll praise this month is one we have reviewed twice (Dec 05 and Oct 07 issues) and recommended in passing *many* times. Yet still we hear from modelers asking for do-it-all battery management tools. Mine quickly became my most important battery management tool, and is used so often I had to get a second one!

The Hobbico Accu-Cycle Elite is an amazingly flexible and accurate dual output battery charger, discharger, and cycler. It operates from an 11 VDC to 14.5 VDC input (like a car battery) for portability, but it comes with a separate 120 VAC power supply for shop and home use. The charger has an On/Off switch, but the AC power supply does not.

Its basic functions include charging, discharging, and cycling, and all three modes can use automatic pre-sets established by the manufacturer, or we can use our own custom settings in most cases. For safety's sake, of course, some settings for Lithium batteries cannot be changed by the user. Possible settings include standard charge rate, quick charge rate, trickle charge rate, peak detection sensitivity (for Nickle cells), discharge current, discharge cut-off voltage (for Nickle cells), charging time limits, peak charging cut-off points (for Nickle cells), trickle charge rates, heat cut-off points, choose from one to five discharge-charge cycles, and more.

Compatible batteries include Lithium batteries of one to three cells (both 3.6 and 3.7 volts per cell), and Nickle batteries up to ten cells. When charging and discharging Lithium cells, it also detects cells with voltages too high or too low to safely charge.



Since custom settings may include many variables, there are ten built-in battery memories in which we can store our most frequently used settings.

There's also a connection for each output where we can connect an optional heat sensor, which can be used to terminate any process if the battery exceeds the set max temperature.

I have only one complaint about the Accu-Cycle-Elite. At some point in its lifetime the charger appears to have been updated to add more capabilities, but the instructions have not been appropriately revised. For example, the instructions clearly state that we cannot use two different stored memories at the same time... but we can.

The Accu-Cycle Elite has so many capabilities it's hard to stop describing them (our latest review took seven pages!). If you'd like more details, look it up on the Tower Hobbies website, or send me an email for instructions on how to order a photocopy of the latest review from the October 2007 printed issue ($3.00 postpaid).

Now, please write and let me know if you'd like to see more (or not) of these "long term use" product reports.

In an earlier editorial I wrote about some possible ways to set up a fireproof "safe box" for charging batteries when you're unable to sit and watch them. Dave Kress, of Oxford, MA, wrote in to add another good possibility, that being a metal mailbox (steel preferred) from Lowes or Home Depot for around $12.00. Thanks, Dave.

-Gordon Banks
glbanks@knology.net

Wife: You always carry my photo in your briefcase. Why do you do that?

Husband: Whenever there's a problem at work, no matter how bad it is, I look at your picture and it makes me feel better.

Wife: Well there you go then! See how good I am for you?

Husband: Yes, I look at your picture and think to myself, "What could possibly be worse than this?"

Penalty fines are like a tax for doing wrong, while income taxes are like a fine for doing well.

A little girl was talking to her teacher about whales, when the teacher said that it was physically impossible for a whale to swallow a human being because even though the whale was a very large mammal, its throat was very small. The little girl argued that Jonah had been swallowed by a whale, it said so in the Bible. Irritated, the teacher repeated that a whale could not swallow a human, it was physically impossible. Then the little girl pouted and said, "Well when I get to heaven I'll ask Jonah myself!" The teacher smirked and asked, "But what if Jonah went to hell?" Then the little girl smiled. "In that case *you* ask him."

An elderly couple was in church one Sunday morning. About halfway through the sermon, the lady leaned over and whispered to her husband, "Honey, I just passed a long but silent fart. What do you think I should do?"

Her husband whispered back, "Put a new battery in your hearing aid."

A teacher was giving a lesson on blood circulation. Trying to make the matter clearer, she said, "Now, class, if I stood on my head, the blood, as you know, would run into it, and I would turn red in the face." " Yes," the class agreed. "Then why is it that while I am standing upright as I am now, the blood doesn't run to my feet?" After a short pause, one little boy replied, "Because your feet ain't empty!"

The school children had all been photographed, and the teacher was trying to persuade them each to buy a copy of the group picture. "Just think how nice it will be to look at it when you're all grown up. You'll say, "Look, there's Jennifer. She's a lawyer now", or "Hey, there's Michael. He's now a doctor." Suddenly a small voice at the back of the room rang out, "And there's our teacher, Mr/s Johnson. She's dead now."

HERE'S HOW...

by Walt Wilson

Share your best ideas and building tips with others. Send your "Here's How..." ideas to...
Walt Wilson, 3000 Persimmon,
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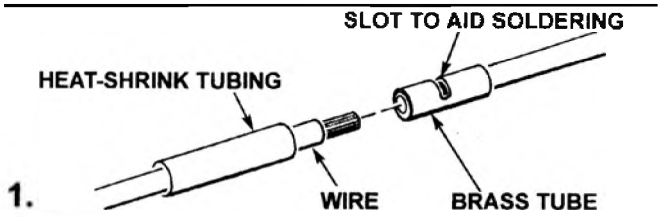
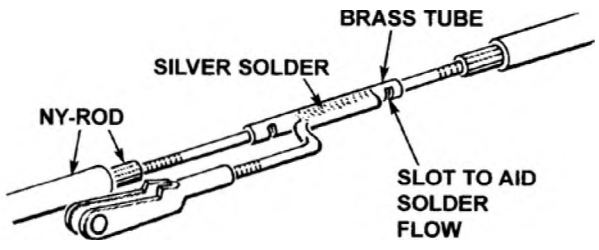
or by e-mail to... rallyo@charter.net
Please include your full name and mailing address. The first submitter of any idea used here will win a one year subscription or renewal to RC REPORT ONLINE. If the subscription or renewal is to be a gift to someone else, please state this when submitting the idea.



1.

1. From Al Knight, of West Deptford, NJ. When making a splice in heavy wires, such as #13 or #16 gage wires on batteries or electric motors, wrapping the wires around each other makes a large, lumpy connection that may not yield the most secure solder joint. Al cuts a 1/2" length of brass tubing, using the smallest diameter that will hold the wires, and cuts a small slot in the middle, as shown in the drawing. Tin and solder the wires into each end of the tubing, using the slot to allow the solder to flow into the joint completely. Cover the finished connection with a piece of heat-shrink tubing, and you'll have a neat and solid connection.



2.

2. From Avey Shaw, of Huntington Station, NY. Some models still use a single servo with pushrods and bellcranks, etc., to control the ailerons. Avey has a method of making his

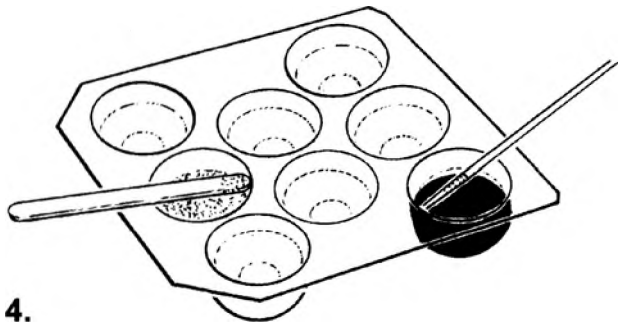
pushrods fully adjustable in length and for centering. Threaded rods are soldered into each end of a brass tube with small slots in the sides for improved solder flow. Another threaded rod is bent into a Z-shape and silver soldered to the side of the brass tube as shown above. The threaded rods are then threaded into inner Ny-Rods with some thread left for adjustments. (Walt's Note; It makes adjustment easier if the ends of the Ny-Rod are pre-tapped to match the threads of the threaded rod being used.) An adjustable clevis is then used on the Z-shaped rod to be attached to the servo. This allows adjustment in three places to get the ailerons set up as desired.

3.

3. Paul Geders, of Florissant, MO, has developed his own tool for cutting MonoKote and other iron-on coverings, to expose a hole in the covered structure. Cut a 5" length of 1/2" hardwood dowel, and drill a 3/4" deep hole in

one end, and press in a suitable size nail or length of music wire about 2" long. Grind, file, and sand the end of the nail to a smooth a finish. Shaping and smoothing the end is easy by spinning the nail in an electric drill while applying the end to sandpaper. Then use epoxy or CA to permanently glue the nail into the hole in the dowel, and your tool is done.

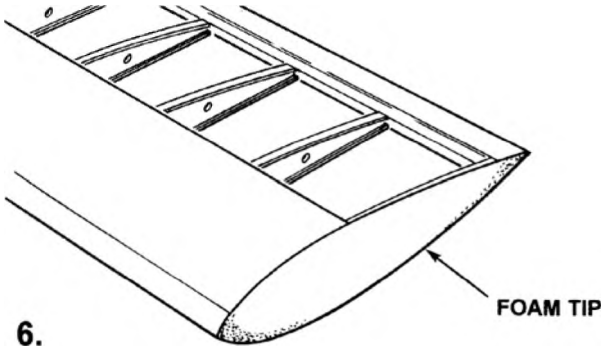
Now heat the protruding end of the nail with a torch, and push it through the covering material into hole underneath, and slowly run it around the edges. The heat will cut through and seal the covering around the edges of the hole.



4.

4. According to Casey Rariden, of O'Fallon, MO, tomatoes often come in plastic trays that can later be used for mixing paint, epoxy, filler, etc., and for sorting parts and hardware. When spoiled, the trays can be discarded and replaced with new trays the next time you buy tomatoes!

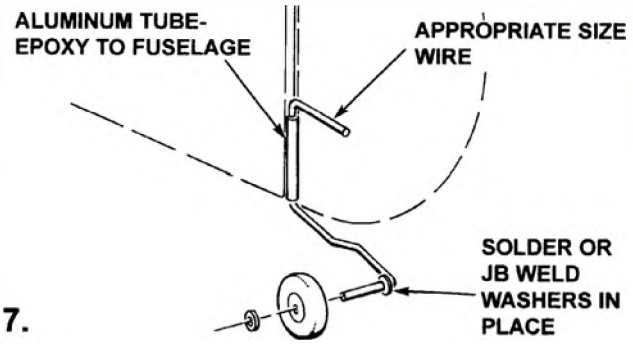
5. (No illustration) One way to balance props is to paint the front side of the lighter blade. Wait until it dries before checking the balance again, however, since paint is heavier while wet. Then if it needs more weight, add more paint. This works especially well on composite props where removing material from the heavier blade is more difficult than with wood. Use fuel-proof paint if the prop is to be used on a glow engine, but almost any paint that doesn't attack the plastic is good for electrics. Krylon "Fusion" and some lacquers attack plas-tic and roughen the surface, but Polyurethane works well in most cases. Clear paint can be used in glossy, satin, or matte finish to match the rest of the prop. The appearance of the prop is essentially unchanged, and the profile of the blade is preserved. This will work on all but the most severely unbalanced props, which should probably be discarded anyway. *(Editor's Note: I like paint too, but when pressed for time, I've had very good luck with using short lengths of clear, cellophane tape applied to the back of the prop's lighter blade. I always figured this would work well with electric models, but I'm finding that the tape stays put for years on glow models as well! Make sure the tape does not extend out over an edge of the blade, and for adjustments remove a little or add more tape. I've used as many as three layers with good success.)*



6.

6. When the model calls for blocks of balsa to be carved and sanded to shape, try using foam instead. The foam is easily cut with a saw or hot wire, and easily sanded to the final shape. It's very light, and certainly less expensive than balsa. A low-temperature iron-on material must be used, however, to prevent damage to the foam, or it could be fiberglassed with epoxy (some polyester resins will attack foam) and/or painted with a variety of foam-friendly paints. Some modelers build entire aircraft using foam, with great results. Inexpensive sheets of insulating foam are available at most home improvement stores.

7. Lightweight, steerable tail wheels are easy to make for most applications, using music wire in the appropriate size, some aluminum or brass tubing for the bearing, a few washers, and a tail wheel. Bend the wire to a suitable shape, leaving the axle portion about 3/16" longer than the width of the tail wheel. Measure the distance from the bottom of the fuselage to the center of the space between the rudder control horn



7.

screws, and cut the bearing tubing to that length. Slip the tubing onto the wire and make a 90° bend at the top for the tiller. Drill a suitable hole in the front of the rudder at the tiller location. Then using solder or JB Weld, in-stall a washer on the bent wire side of the wheel to keep it from rubbing. Install the wheel, and use a piece of thin cardboard (like a business card) on the axle to protect the wheel while soldering (or gluing) a second washer as the wheel retainer. Wheel collars can be used if weight is no consideration. Cut a groove in the back of the fuselage, deep enough to center the tube on the hinge line, and glue it in place. If the fuselage has not yet been covered, a piece of fiberglass cloth can be epoxied around the tubing for extra strength. If the tail wheel is being installed on an ARF, some covering material or trim may help reinforce it. When the rudder is being installed, place a bit of epoxy on the tiller, and mount the rudder in the normal fashion. Bend the wire if necessary to align the tail wheel with the rudder, and you're done!

Folks, we need good ideas! Please send yours, and earn a free subscription!

-Walt Wilson (see addresses at top)

THE BIG PICTURE

by Dick Pettit

Modeling activities have been mighty slow lately, due to the hot weather and our sad economy. With so little money changing hands right now, many distributors and manufacturers are understandably reluctant to invest in new products. I'm still anxiously waiting the release of a really nice giant WW1 biplane kit that I'd hoped would be completed in time for Monster Planes in October. Now it looks like that project will be delayed a while. But I trust you're all hanging in there, hoping and waiting to see if and when our economy will recover. I know it doesn't look good right now, and our current administration is anything *but* confidence inspiring, but we've been through this before and survived. Even though it may take time, new people, and new ideas, I'm sure we'll come through this mess again.

My column this month includes several interesting photos from readers, which we always appreciate. I've also included the results of some testing I've done on five different adhesives, four at the same time, and one late

arrival later on. So, let's get started with this month's "The BIG Picture".

SPIFFY SPACEWALKER

In **Photo 1** below we see Mark Lofgren, of Creedmoor, NC, and his 1/3 scale SIG Spacewalker. The model is covered with Coverite and painted with Nelson paint products. The completed plane weighs 18 lbs. with its Brillelli 44 gas engine turning a big, 20x10 prop. Mark chose a Spektrum DX7 (2.4 GHz) radio system

Photo 1: Mark Lofgren, of Creedmoor, NC, and his 1/3 scale SIG Spacewalker.

Photo 2: This outstanding Aeromaster belongs to Raoul Trudell, of West End, NC.

to control his beautiful Spacewalker as he guides it through the sky.

ANOTHER AWESOME AEROMASTER

I've always liked the way the Great Planes Giant Aeromaster. I've built one from a BIY kit and assembled another as an ARF. Rick Cawley, my friend and assistant test pilot, liked mine so much he went out and bought one for himself!

There are tons Aeromasters embellishing R/C flying sites around the world. The one seen here in **Photo 2** belonging to Raoul Trudell, of West End, NC. Powered by a Fuji 43 gas engine, it weighs about 18 lbs., and Raoul says the only thing he did differently from the assembly manual was to add the pin-striping at the upper and lower wing joints, using automotive striping tape. He says the model is a genuine pleasure to fly, and I certainly agree.

COMPARING FIVE DIFFERENT GLUES

Building model airplanes well requires skill, craftsmanship, talent, creativity, judgment, patience, and all that good stuff, but it also takes something anyone can just go out and buy. We also need glue! We use glues to fasten many parts and pieces of our airplanes together, hoping the resulting joints are strong enough to withstand the stresses of transportation, handling, and flight. There are many different glues available, however, so which glues work best with which materials?

Our flying models borrow construction techniques from (usually vintage) full-sized aircraft (although rare, some models use metal structures). These techniques might consist of forming the frame of the model using thin strips of light wood such as balsa, then covering it with fabric, and finally painting the fabric to form a light and sturdy frame which is also air tight.

Other construction techniques consist of using formers and longerons for the fuselage, with spars and ribs forming the wings and tail surfaces. More robust designs may use solid sheets of wood to form certain parts, or may employ a composite structure consisting of an expanded polystyrene core laminated with a surface veneer of wood (often balsa or obechi) or fiberglass, which protects the core and provides more strength. But all of these construction techniques have one thing in common, they require some way to bond one part to another. We use glue!

Now let's examine some of the more popular types of adhesives available today, and where they should and should not be used. To satisfy my own curiosity, I ran some very non-scientific tests to compare the results of several different adhesives, that I hope will show which adhesives are best suited for which materials.

Let's begin with cyanoacrylate adhesives. That long name may not sound familiar, nor does it roll easily off the tongue. We know these adhesives more commonly by their brand names, such as Crazy Glue, Hot Stuff, Insta-Bond, Super Glue, and, of course, the ZAP lineup. "CA's", for short, is the general term for these quick-bonding instant glues used to mend or join wood, metal, plastics, glass, and others, with some special formulas for special applications. Unfortunately at times, the list of CA-friendly materials includes human skin. Fortunately at other times, however, CA's have been and are used today to bond flesh in surgical procedures, with military field hospitals (where time is so critical) being one of its first such uses.

CA's are actually an acrylic resin, and not a traditional adhesive at all. Other acrylic resins include such products as automotive body repair filler, and the clear material often used to embed small objects, often as memorabilia (rare coins, four-leaf clovers, etc. sealed forever in a clear, acrylic cube). Acrylic resins typically consists of two separate liquids, with one used very sparingly as a hardener. In the case of most CA's, the hardener is often simply moisture. CA is a tenacious adhesive too, particularly when used to bond non-porous materials and those containing even minute traces of water. The moisture is why it's so good at bonding body tissue, and its curing speed has been of great benefit to rushed (as in military combat zones) and suture-less surgery.

Another very popular family of adhesives are the more traditional "wood glues." The most common of these are polyvinyl acetate (PVA), also known as white glue, and the aliphatic resin emulsion glues, commonly called "carpenter's glue" and "yellow glue". These have similar relative strengths, but the "white" glues allow more slip during assembly for proper alignment and positioning, while the "yellow" glues have more initial grip where some strength is needed very quickly.

Epoxies (polyepoxides) are a thermosetting polymer formed from the reaction of an epoxide resin with a polyamine hardener. Epoxy has a wide range of applications, strengths, peculiar requirements, and curing times. Epoxies can be developed to suit almost any application. They are exceptional adhesives for wood, metal, glass, stone, and some plastics. Epoxies can be made to cure flexible or rigid, transparent or opaque (even colored), and fast or slow curing. Epoxies are practically unmatched in heat and chemical resistance among common adhesives. In general, epoxies cured with heat will be more heat and chemical resistant than those cured at room temperature. The strength of epoxy, however, decreases at temperatures above 350˚F (177 ˚C). *(Editor's Note: We sometimes use our covering material heat guns to heat an epoxied joint hot enough to release the bond.)*

The majority of construction practices used in today's model airplanes requires bonding several types of wood, to include balsa, lite and aircraft plywood, and several different hardwoods. Balsa to balsa joints are probably the most common, and most of us have used several or all of the adhesives types I've mentioned. Balsa to plywood and balsa to hardwood are a

Photo 3 shows the first four glues tested.

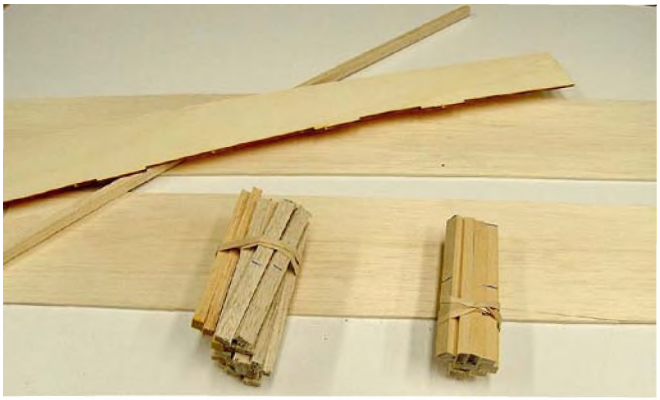


Photo 4 shows the wood I used.

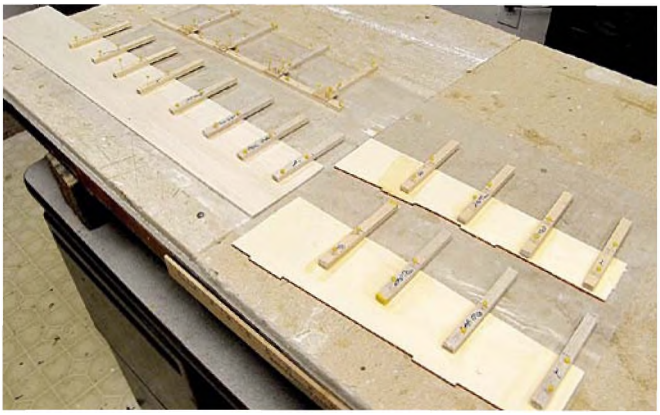


Photo 5 shows the sticks glued to the sheets

bit more difficult to bond, but it can be done using the correct adhesives and techniques.

For my tests I used 4" long balsa and hardwood sticks cut from 1/4x3/8" stock. The sheets were 1/8" balsa and lite-ply. These materials are commonly use in traditional model construction, and all "stick to sheet" joints will be 2" long. The adhesives I used include yellow

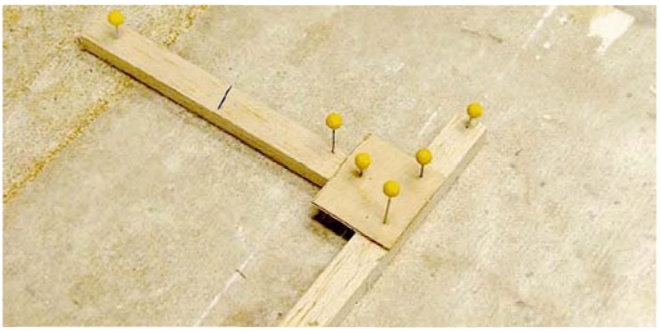


Photo 6 shows the butt-joints with the plywood gussets.

carpenters glue, Pacer ZAP thin CA, Pacer ZAP-A-Gap Medium CA, and Pacer 30 Minute Epoxy, as seen in **Photo 3**. Each adhesive was tested with three different types of joints, as seen in **Photo 4**

The first joint was a hard balsa stick glued to a medium density balsa sheet. The second joint was another hard balsa stick glued to a sheet of lite plywood. The third joint used a spruce stick glued to balsa sheet. My fourth joint used another spruce stick glued to lite plywood. The fifth test used two hard balsa sticks glued to each other in a "butt joint" (with the end of one stick glued perpendicular to the other). Since this type of joint alone is extremely weak, builders usually reinforce such joints with wood gussets in the corners. For this I'll use pre-cut squares of 1/32" plywood.

In **Photo 5** I've glued the sticks to the sheeting so you can see what they look like. **Photo 6** shows the T-joints for the fifth test. The pins were used to keep everything together place while the adhesive set.

I used my normal amount of adhesive for each joint, and then allowed each to sit undisturbed for 24 hours. I then used an electronic pull-scale (1-55 lbs.) to determine the pounds of force needed to break each joint, by pulling the stick sideways (parallel to the sheet material) at a distance of 1" from the edge of the sheet (see **Photo 7**). I chose this 1" distance because I wanted the glue joint to break, not the wood. Then I recorded the amount of pull force needed to make the joint fail. I hope these tests will show the relative holding strength of each

	Yellow Glue	Thin ZAP	Medium ZAP	*30 Min Epoxy*
Balsa Stick to Balsa Sheet	**15.7** *joint failed*	**16.5** *joint failed*	**14.9** *joint failed*	***17.1*** joint failed
Balsa Stick to Plywood	**15.0** *joint failed*	**12.5** *joint failed*	**16.0** *wood fail*	***24.9*** wood fail
Hardwood stick to balsa	**20.3** *joint failed*	**24.6** *joint failed*	**26.3** *joint failed*	***20.3*** joint failed
Hardwood stick to ply	**38.0** *ply broke*	**36.9** *ply broke*	**38.0** *ply broke*	***42*** wood broke
Balsa Tee Joint	**24.0** *joint fail*	**8.0** *joint failed*	**5.0** *joint failed*	***18*** joint failed

Table 1

Photo 7 shows how I pulled on the stick until the wood or glue joint failed. The pull-scale registers up to 55 lbs. in pounds and tenths.

Photo 8: Here the lite-plywood broke, leaving the hardwood stick and glue joint intact.

Photo 9: But in this test the balsa stick broke, leaving the lite-ply and glue joint intact.

adhesive, and possibly show why certain adhesives work better with certain materials.

Once all the joints were tested to failure, and the force values recorded, I began to analyze the results (see **Table 1**). Note that the balsa stick joints all failed at approximately the same pressure, except for the one using epoxy on plywood. Most of the hardwood joints also failed at about the same force. One really interesting outcome is that when the hardwood sticks were glued to the lite-ply sheeting, the plywood failed every time (see **Photo 8**). This indicates that a hardwood to lite-ply joint is stronger than the lite-ply, and that *all* of the adhesives tested created joints stronger than the woods being joined.

Another interesting result was the test of the balsa stick glued to plywood sheet with 30 minute epoxy. That was the only joint where the balsa stick broke (see **Photo 9**), indicating again that the joint was stronger than the balsa.

Perhaps most interesting result of all, however, were the T-joints with plywood gussets. The CA joints broke easily at the butt joints, but adhered well to the plywood (see **Photo 10**), while the other butt joints were stronger. This tells me that CA's and butt-joints don't work well together. I've always used yellow glue for joints like this anyway, and will continue doing so until something better comes along. *(Editor's*

Photo 10: In this test using medium CA, the butt-joint failed, but the balsa stick was torn apart at the plywood plate.

Note: When using any CA on a butt joint, it's best to pre-treat the end of the stick with CA to first fill the pores. Otherwise, when applying CA to the joint, the thin adhesive often wicks into the raw end-pores so quickly, there's too little CA left at the joint to form a strong bond.)

You should draw your own conclusions from these tests and your own personal experiences. I think my greatest surprise from all this was the high strength of the hardwood to plywood joints with all four adhesives, where the wood broke every time! I also feel that the glues requiring significant time to work, provide a superior bond. Some people feel that more time the glue to soak in better, while others believe it simply allows more time for a stronger chemical bond.

I later received an adhesive I'd wanted to include it in the tests, but it came from Canada, so there may have been some delays in customs. Nevertheless, I ran the same tests with the new adhesive shortly after it arrived.

This one is called "SuperPhatic", and it's available from Ontario Adhesives, 1337 Lyndon Way, Kingsville, Ontario, Canada N9Y 2R2, Phone 519-733-0416, or email...

info@ontarioadhesives.ca

According to their literature and website, SuperPhatic is a high-penetrating yellow aliphatic glue for close-fitting, pre-assembled joints. It promises to dry quickly, and bonds wood, foam, and some plastics. Waterproof when set, it's said to produce tougher joints than most aliphatic glues. That sounds great, but let's test it.

SuperPhatic comes in a 50 ml plastic bottle similar to those in which instant adhesives are sold, as seen in **Photo 11**. It has a small opening at the top, plus a small metal dispenser tip that regulates the amount and direction of adhesive flow when applying it to the surfaces being joined. The adhesive has no odor to speak of, it's much like whole milk in consistency, and it cleans well with water. It appears to wick into wood and other porous materials to provide a good, tight bond.

Photo 11: SuperPhatic adhesive and its application nozzle

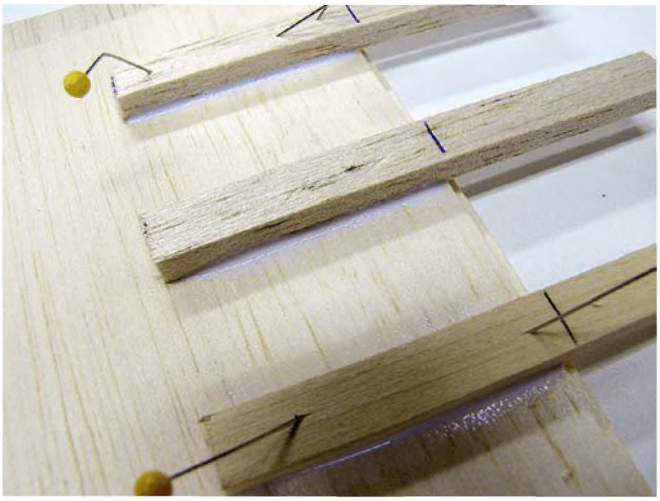


Photo 12: SuperPhatic glue applied to one edge of some balsa pieces

First I tried using SuperPhatic on some scrap balsa just to see what would happen. I placed a balsa stick on a piece of balsa sheet, applied a tiny bead of SuperPhatic on one edge only, and waited for it to wick into the joint. When the glue was still there about 30 seconds later (see **Photo 12**), I shrugged in disappointment and walked away. When I came back just minutes later, however, the liquid had soaked into the joint, just as advertised. I quickly pulled the joint apart (see **Photo 13**) to judge how far it had wicked in. I was pleased to find that it had wicked all the way across the width of the stick! Remember now, I'd only applied it to one edge of the stick!

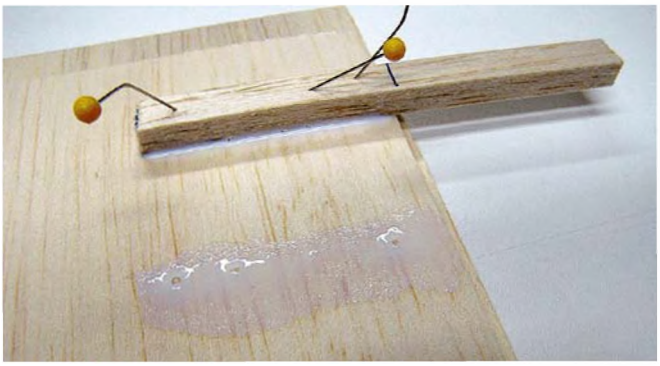


Photo 13: After just a few minutes, the SuperPhatic had wicked totally into the joint.

I re-assembled the joint, set it aside, and went on to run the same tests I performed with the other adhesives. Ontario Adhesives says that SuperPhatic will dry in as little as two hours, but like the others, I let it sleep for 24 hours.

I later removed all the pins, and began testing the joints just as I had for the other four adhesives. My findings were as follows:

Balsa Stick to Balsa Sheet: The joint broke at 16 lbs.

Balsa Stick to Plywood Sheet: The wood broke at 18 lbs.

Hardwood Stick to Balsa Sheet: The joint broke at 38.6 lbs.

Hardwood Sick to Plywood Sheet: The wood broke at 39.0 lbs.

Balsa Butt Joint: The wood broke at 14.3 lbs.

When comparing these results to those of the other four adhesives (see **Table 1**), SuperPhatic appears to perform as well or better than the others (see **Photo 14**). The hardwood stick glued to plywood and balsa broke, leaving the glue joint intact. This occurred at a pull strength almost twice that of the other adhesives, just as in the case of the balsa sheet, so the strength of the wood itself appears to differ. The balsa butt-joint was also stronger than the other adhesives, but once again the wood itself broke. In all other cases, the glue joints appeared to be of about the same strength.

I then edge-glued a few pieces of balsa sheeting to form a test piece like that used for sheeting wings and fuselages. Rather than use masking tape, however, I just pinned the two

Photo 14: Here's what happened when I pulled apart some of the new test pieces.

pieces of sheeting together, applied SuperPhatic to the joint, and let it sit for 24 hours. I then removed the sheet from the table and sanded off the excess adhesive. The adhesive was still a little rubbery, but it sanded easily, leaving a smooth joint that was, of course, stronger than the wood itself.

Probably the only thing I'll do differently when using SuperPhatic, is to remove the little syringe tip from the bottle after use, and store it in a small container of water to dissolve the glue and keep the tip clean. If the glue is allowed to cure in the tube, the tube will have to be replaced.

I'll continue testing SuperPhatic when I start building my next kit, which will hopefully be soon. Until then I'll be trying it on other projects, and I'll keep you posted on how well it works. In the meantime you may want to try it yourself. If you do, please tell them you read about it at R/C REPORT Online!

As time goes by I may be repeating these tests when new adhesives become available. If you'd care to repeat these tests with your favorite adhesives, please let us know your results.

THREE BEAUTIFUL MODELS

I received several photos from Bob Germaine, of Northern Utah, a few weeks ago, and have been looking forward to sharing them

Photo 15: Bob Germaine's Weddell-Williams Model 44 was built from an AMR kit.

with you. The first is the beautiful Weddell-Williams Model 44 seen in **Photo 15**. Built in 44% scale from an AMR kit, the 120" span model weighs 52 lbs. dry, powered by an RCS 250cc 5-cylinder radial engine turning a monster 32x12 MCS propeller. It relies on a Futaba 9C radio for guidance, with Hitec HS-645MG servos and Duralite batteries. Covered with Stits Lite and painted with Stits PolyTone paints, the graphics are from CalGrafx, and the flying wires are from AeroScale Products. Bob says it's a big sport flier with a generous airfoil providing excellent low flight characteristics, with no tendencies to snap or tip stall.

Photo 16: Bob's Gilmore Red Lion was built from Wendell Hostettler plans in 25% scale.

Photo 17: Bob's 33% scale WACO YMF-5 was also built from an AMR kit.

Next is Bob's Gilmore Red Lion seen in **Photo 16**. Built from Wendell Hostettler plans in 25% scale from Precision Cut Kits parts, the 84" span model weighs just 28 lbs. dry, powered by a 3W-85iB2 twin turning a Mejlik 24x10 prop. This model too uses a Futaba 9C radio system with an Xtreme Link 2.4 GHz conversion and Futaba S3004 servos. The Covering is Stits Lite with Stits paint and CalGrafx graphics. The flying wires come from AeroScale Products. Bob says this one requires serious attention from the pilot, as it's very fast and prone to snaps, but with true scale performance.

Finally we come to the beautiful 33% scale WACO YMF-5 seen above in **Photo 17**. Built from another AMR kit, the big yellow bird has a huge, 120" upper wing, and weighs 61 lbs. with its RCS 250cc 5-cylinder radial engine and MCS 32x12 propeller. Sticking with tradition, the WACO too is covered with Stits Lite, but this one was painted with Randolph dope. The graphics come from Cajun R/C, and the flying wires again come from AeroScale Products. Another (or possibly the same?) Futaba 9C radio controls the big model, using Hitec HS5955 digital servos and Duralite batteries. Bob says the WACO is very stable, very scale, and easy to land... like a brick without power! I guess that holds true for many large biplanes, and this one is certainly large.Our thanks to Bob Germaine for sending these great photos of his equally great models.

Well, that's all I have this month. If you have any thoughts about possible future articles or projects, please let us know so we can evaluate your suggestions, and possibly get them started.

See y'all next month.

-Dick Pettit
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Durham, NC 27713
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A rude driver was stopped by a policeman for rolling past a stop sign. The driver argued that he had slowed to a crawl, which was just as safe as stopping, but the officer continued writing the ticket. When the driver demanded to know the difference between stopping and slowing, the obliging officer pulled out his flashlight, began rapping the driver on the head, and asked, "Now, sir, do you want me to stop or just slow down?"

RADIO RAMBLINGS

by Tony Stillman

First let me apologize for my absence last month. I got caught up in some personal projects and missed the deadline by a long shot. I'll ry not to let it happen again.

I want to start this month with more info on the Sanyo batteries I told you about in my July column. Red Scholefield (of Red's R/C Battery Clinic) agreed to look at a brand new 9.6 volt, 2000 mah NiMH transmitter battery that I was unable to cycle. Since he has better gear than I for testing batteries, and he's a leading battery expert, I hoped he could enlighten me... us. Here's what he has told me so far:

Hi Tony,

I've completed my first tests on your battery. The voltages showed quite a bit of spread in the open circuit voltage, with a low cell of 1.14 bolts, and a high cell of 1.216 volts. This is more than I would expect, but not totally out of the ordinary. After a full charge and a 12 hour rest, the high and lows were 1.367 (the same cell that read high before) and 1.343 (not the same cell that read low earlier). We can't draw much from this, but at least none of the cells were shorted or had a significant self-discharge rate over the 12 hour rest.

Discharged at 400 ma, the discharge curve was normal, with no stepping that might indicate a failing cell. The delivered capacity was 1740 mah, only 87% of it rating. This is not real good for a Sanyo product.

What have we learned so far? Only that this battery was apparently on the low side of the production distribution, which is unusual for Sanyo. They may have lowered their standards a bit to stay even with the competition, knowing that few people have the ability to accurately check the true capacity.

I'll soon run individual tests on each cell to see how they stack up. Based on the normal discharge curve, however, I don't expect to see much difference. I'll also test four cells picked at random with just a short rest after a full charge. Then I'll test another two after 15 days, and the final two after 30 days, to see if there's an abnormal self discharge rate. *-Red*

Red's R/C Battery Clinic

www.hangtimes.com/redsbatteryclinic.html

"Check us out for revolting information."

It appears that my readings were about the same as Red's, so it will be interesting to learn what he finds. We'll share that next time.

I recently received an email from a long time reader of *"R/C REPORT"*, Ken Gardner.

Hi Tony,

I've read your column in "R/C REPORT" for some time now, but this is the first time I've had a question about electronic gear.

I have a Futaba FAAST 7-ch system in a Sig "Sun Dancer", the big one. Last week I left my transmitter on and ran the battery down. I recharged it at the field, but when I turned on the receiver it didn't respond. I attempted to re-bind the receiver, but it would not lock on. When I got home I tried to re-bind two other receivers on that same transmitter, and they worked okay. I sent the non-binding receiver to Futaba for checkout and repair.

The only reason I could come up with for the failure was that I was putting too much voltage into the system, as it's powered by a 2-cell A123 Lithium Ion battery (7.2 volts). Have you heard of anyone having a similar problem?

Thanks, *Ken Gardner*
Murray, Utah

Yes, I have heard of this kind of problem, but not with Futaba gear. I don't believe the higher voltage of the A123 battery would cause any problem to the receiver. Most of the time the only real concern is for the servos. Most servos will work with 6.5 volts, but some are designed exclusively for 4.8 volts. In your case, however, the servos are fine but the receiver won't bind.

I don't think the transmitter is at fault either, since it works fine with two other receivers. So what's the problem? I'm guessing that something in the receiver failed. I don't think it was due to high voltage, but let's wait and see what Futaba's service techs say. Hopefully Ken will let me know what he learns.

I *have*, however, had customers call me about brand new Spektrum receivers that would not bind. Apparently there were quite a few of these released, but Horizon Hobby has replaced them, at least for the customers I spoke to.

An odd but surprisingly common theme I'm hearing from many R/C flyers these days is that they somehow have the idea that 2.4 GHz radio gear never fails! Boy, wouldn't *that* be nice? That would be almost like having a model airplane that wouldn't crash! And I've never seen one of those, either (and especially those that Gordon flies!). Sorry, folks, but if an item is made by mankind, it will break. Anvils and railroad rails break. Air and water doesn't break, but then, they weren't made by mankind.

Guys, this new radio gear is very, very good, but like almost anything, it has to be properly maintained. Keep in mind too that it isn't often the RF link that fails. It's usually a battery, a defective pot in the transmitter, or a wire (anywhere) that breaks. I recommend service inspections at least every two years for your gear. The stuff we have today is great, and time passes quickly, so stay on top of your maintenance schedules if you want the ultimate in reliability.

Here's a note from Frank Roales.

Tony, I have two Ace Micropro 8000's with "Rubber Ducky" antennas. Both transmitters have been sent to you for regular checkups, and both are working fine. I do, however, have a question that might be of interest to others who regularly read your column.

What's the best way to perform a radio range check with one of these "Rubber Ducky" antennae? Regular range checking has been covered in many magazine articles, but they never mention this type of antenna.

Thanks, *Frank Roales*

Actually, Frank, I'm not sure I've ever written anything about these antennas either! A Rubber Ducky antenna is one that's much shorter than the original 27, 50, 53, 72, and 75 MHz system antenna, and is very common now in indoor R/C flying. Their advantage is that, much like our newer 2.4 GHz transmitter antennae, we don't have to extend them, or worry about accidentally testing their strength by sticking them into a spinning prop (which happens a lot more often than you might think!). They also have a very good RF signal pattern that helps eliminate

the dead spot off the very end of a standard antenna. Their downside is a slight output power loss, but it is a *very* small amount, and we normally have much more than we need anyway.

One of the more popular Rubber Ducky antennae is sold by the Smiley Antenna Co., of El Cajon, CA. Called the "R/C Power Duck", it's designed for easy replacement of the original antenna. It also uses a BNC connector on the base, so you can very easily remove the antenna for stowing in your transmitter case. You *do* use a transmitter case, don't you?

When using any Rubber Ducky antenna, I simply remove the antenna altogether while performing a range check. Using the procedure described below, you should still get at least 150 feet of range.

And since I still get questions on how to properly perform radio range checks, most of which I assume come from newcomers to R/C, I went back and pulled the following from an earlier column. I hope you find this helpful, but note that this procedure is for the older MHz (27, 50, 53, 72 and 75 MHz) systems, *not* for the newer 2.4 GHz Spread Spectrum systems. For proper range checking the 2.4 GHz stuff, see your radio's user's manual for complete details. There are some significant differences for different manufacturers for range checking the Spread Spectrum systems.

The following procedure will work with any brand of MHz radio equipment commonly seen at the flying field today. First, assemble your model as usual for flight. Next, fully extend the antenna, but then collapse it until only the last section (that with the largest diameter) remains exposed.

Using only this approximate 6" long section, first turn the transmitter on, and then the receiver in the model. Now slowly back away from one side of the model. Keep the bottom of the transmitter against your stomach (which for many of us, puts the transmitter a lot closer to the model!). As you walk away, work the elevator or rudder control smoothly in both directions. You're looking for any hesitation or jerkiness in the control. When you find a "dead spot" while backing away, stop and continue testing right there for a moment. You may find that by twisting your body from side to side you can make the system "come and go". Leave a mark of some kind on the ground so that you can come back to this same spot later.

Then continue backing away a few more steps, and you'll most likely see full control return. So keep backing away, but stopping at any "dead spots" you find, and again leaving a mark at each one as before. Keep on doing this until you are finally so far from the model you loose and cannot regain control (by turning side to side). You may find the controls getting twitchy at some point. If so, mark that spot as well.

Once you reach the point where you no longer have control, stop and begin walking *toward* the model until you regain full control. Then stop, leave a mark at that point, and then resume walking all the way back to the model, *counting your steps as you go!* If you get 50 or more steps (assuming about 30" steps), that's 150' or more, so you're good to go. Note however that this is *least* range you should get, so if yours is any shorter, *don't fly!* Your system is telling you *"I'm not happy!"*, so *listen* to your system, play doctor, and find the problem now before it kills your airplane! This is, after all, the whole purpose of range checking! If you find that you have, for example, only 40 to 45 steps of range, and you're really heart-set on flying that day, then move to a different location and repeat the range checking procedure. Being close to large and/or metal objects like cars, buildings, metal fences, etc., can make a difference. But if your range check was in a wide open, interference-free area and you still got less than 150' of range, fight the temptation! Do not fly until you find and fix the problem.

(Editor's Note: I'd like to inject something here. I've seen guys immediately pack up and go home after failing a radio range check, only to find a very quick and easy solution later. Since some of us live a considerable distance

from our favorite flying site, why not try some simple cures before packing it up for the day? First, try the range check again from the other side of the model, or from the nose or tail. If I get a good range check from any angle, I consider the radio itself "good to go", but I'll check the routing of the receiver antenna wire before flying. I don't like having my receiver antenna wire pass within 1" of a servo, but I'll accept 1/2" if I get a good radio range check while exercising that same servo. If a failed radio range check occurs with new servos, I'll disconnect one servo at a time, and repeat the range check to see if anything changes. It might be a faulty servo causing the problem. I've seen bad servos at the field, so I carry an extra, known-good servo in my transmitter case. If none of the above helps, then I'll perform my first trouble-shooting steps by asking if anyone else at the field has a model on that same frequency. If so, I'll ask to use their model and transmitter for more range checks. Will my transmitter pass the range check with their model? Will their transmitter pass the test with my model? This helps determine where the problem lies, and may lead to an on-site cure.)

Now, about those "dead spots" you noted and marked during the range check. If your radio system failed the range check, walk back to those dead spots, checking their distance from the model. The distance is not important to you right now, but can help a service tech understand and maybe reproduce your problem. This kind of problem is usually caused by an out of tune receiver and transmitter combo, or poor sensitivity in the receiver.

Poor receiver sensitivity is not usually adjustable, and it often means that a component has lots some of its gain. This can be very hard to track down sometimes, and some components that cause this are not easily replaced. In many of today's modern receivers, in fact, a bad SMT (surface-mount technology) component may not even be available, so the only fix is replacing the whole receiver.

The good news is, sometimes there are factory updates to receivers that increase or stabilize their sensitivity. Check with your service center before throwing away a poor performing receiver.

The *ultimate* range check is to do the check while the engine is running at a high idle and being safely restrained. Another person holding the model may work, but it's best to use a small but adequate holding device. Having a human body close-by can affect a range check.

It's also important to avoid range checking while other transmitters are operating, even if they're on a different frequency. They can short-

Photo 1: My "Bootlegger II" radio range test fixture. Note the tray just ahead of the canopy.

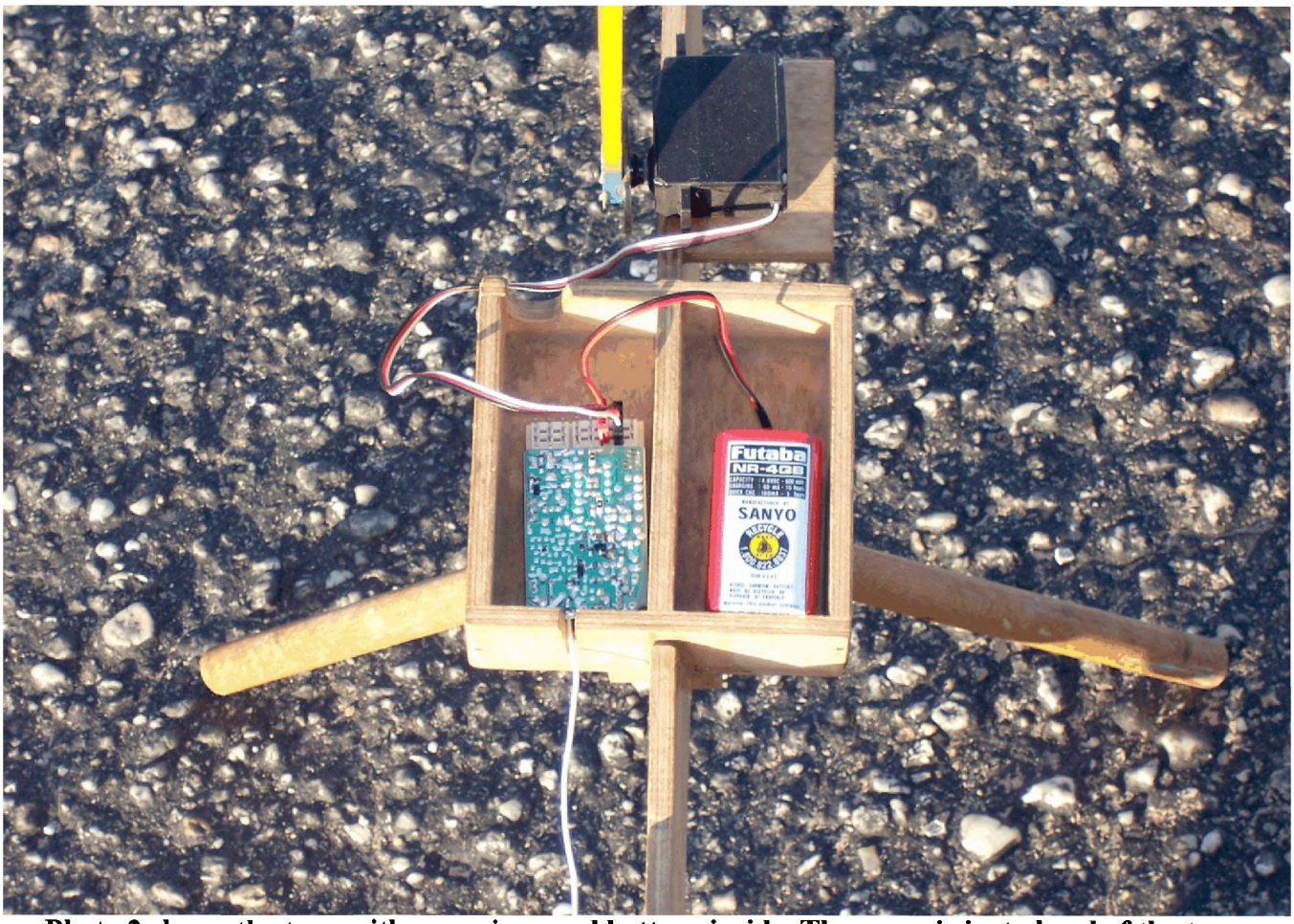

Photo 2 shows the tray with a receiver and battery inside. The servo is just ahead of the tray.

en your range check distance. If you're at a busy flying field where you have no choice, at least move as far away as you can.

Since I range check so many systems that are not in their airplanes, I built and use a special test fixture (actually a fake airplane!). All it really amounts to is a silhouette of a model, cut from plywood. I included a small tray at the front to hold a servo, battery, and receiver. At the tail I glued a clothespin to hold the far end of the receiver antenna.

The servo has a balsa pointer arm attached to the servo arm. This pointer arm is painted a bright color (white, orange, or yellow) to allow easy visibility during the range check. **Photo 1** shows my "Bootlegger II" test fixture, which I built in the late 1970's when I was flying a Bootlegger pattern plane designed by Steve Helms. Mine has the outline of a P-51, but the shape is totally insignificant. You could simply use a long stick with a tray at one end. The only important aspects are that the receiver antenna is fully extended, and that the servo's movement can be clearly seen from at least 150' away. The canopy area is simply a cutout that provides a neat handle for carrying the fixture. The wear and tear reveals the literally *thousands* of range tests that this device has helped perform over the years. **Photo 2** shows the tray with the receiver and battery. in place.

Got questions? Need help with radio problems? Let us know, and we'll do what we can to help, and then share the experience with others.

Y'all have a good time out there, but play nice and play safe, okay? See you next time.

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Bird on a Wire

by Terry Dunn

Last month I introduced you to some of the basics of Aerial Photography (AP). Just like a first-year school teacher, I'm studying the text book the night before I give the lesson, and I'm grossly underpaid. I'm slowly learning some new techniques to make my videos better, and most importantly, I'm having a lot of fun. This month, I'll talk more about my AP airplane, and we'll look at some of the ways to watch your airborne videos.

As mentioned in my previous column, I was shopping around for a Multiplex Easy Star to use as an AP platform (see **Photo 1**). This is a very popular airplane for this task because it's a docile flyer, its pusher propeller is out of camera view, and it's large enough to comfortably haul around a decent camera. The only problem was... nobody seemed to have an Easy Star in stock! Did I mention that they're very popular?

With no Easy Star in my immediate future, I was scanning my workshop for a suitable

Photo 1: The Multiplex Easy Star is a popular plane for AP. It's a large and gentle flying park-flyer that doesn't mind carrying a light camera. Having the pusher prop behind the wing leaves a clear field of view for a forward-facing camera, too. (Multiplex USA photo)

alternate when I stumbled across the carcass of another Multiplex model, the Twinstar. When I bought this plane about ten years ago, I made it look great with a custom paint job and homemade decals. It is, however, no longer such a pretty picture. As we say in Texas, this model was "rode hard and put away wet!" And boy does it show. Even ignoring the damage from its most recent cras... mishap, it bears the scars of countless repai... adjustments and general abuse. Ugly as it may be, however, the Twinstar has always been a great-flying airplane. Despite their fundamental design differences, the Twinstar has the same AP-friendly traits as the Easy Star. The only difference is that instead of a single pusher prop, the Twinstar has two tractor props on the wing. But either method allows a nose-mounted camera to have a clear forward view, and plus, twins are cool!

Multiplex now has a newer version of the Twinstar called the Twinstar II (see **Photo 2**). The two models look much the same, but the younger edition features a few refinements. The main difference is that the Twinstar II is made of

Photo 2: Multiplex has replaced the old Twinstar that I use. The newer Twinstar II has a few internal design changes and is made of a tougher foam. Still, both versions are good aerial photography platforms. (Multiplex USA photo)

Photo 3: Creating a custom mount for my Aiptek A-HD+ 1080P camera was as simple as removing some foam in front of the Twinstar's battery compartment. My Flip Ultra camera can also be fitted into the nose.

Elapor foam instead of the original's beaded polystyrene foam. Elapor is a bit more damage resistant and it bonds well with regular CA adhesives. I've always used epoxy and/or Gorilla Glue to repair my older Twinstar. So when my current Twinstar suffers its final crash, I'll probably replace it with a Twinstar II. With regard to AP duties, either version should work just fine.

The Twinstar comes with two "Speed 400" brushed motors. I originally used two, 8-cell 1700 mah NiCd batteries. A few years ago, however, I upgraded the power system to use two TowerPro 2408-21 brushless motors, a pair of TowerPro 18-amp ESC's, and a big, 3-cell 3000 mah LiPo battery. Even with the 6 oz. Aiptek A-HD+ 1080P video camera on board, the Twinstar is a few ounces lighter than it was with its original power system. With more power, less weight, and high-definition eyes... well, you gotta love that!

To mount the camera in the nose of the Twinstar, I forfeited the canopy, which is also the cover for the battery compartment. I used a sanding drum in my Dremel to hog out some foam in front of the battery compartment. I shaped the foam so that the camera would face forward in a slightly nose-down attitude. Lastly, I added patches of adhesive Velcro (the hook side) to the airplane and the top of the camera. A loop of Velcro then holds it all together. Coincidentally, the Velcro strap covers the camera's microphone and helps reduce some of the wind noise (see **Photo 3**). With all of these changes, the Twinstar was just slightly nose-heavy, and thus "perfect."

My first AP flights with the Twinstar were also the first time I was able to capture good footage with the Aiptek camera. My prior attempts using other airplanes were spoiled for

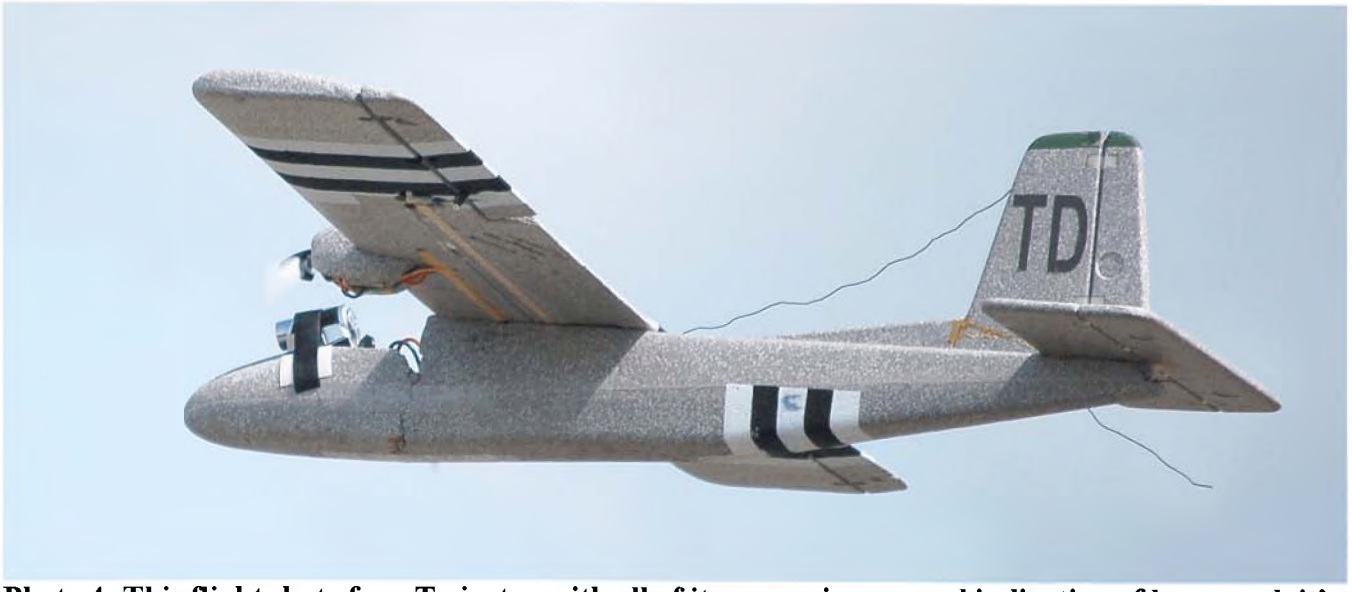

Photo 4: This flight shot of my Twinstar with all of its scars gives a good indication of how much it's been flown and enjoyed for 10 years. Note the downward angle of the camera in the nose. (James Lemon photo)

a number of reasons, with most of them related to how the camera was mounted to the plane. A rubber band would squeeze a button on the camera, or I'd have to point the lens too far down to ever see the horizon, or I would inadvertently flip the focus switch out of the "infinity" setting. All of those issues went away with the Twinstar. Now the Aiptek has a custom mount that points it in the right direction and shields its buttons from ham-fisted mistakes.

Of the four aircraft that I've used for AP, the slow and smooth flying Twinstar is my favorite. Compared to the often shaky videos taken from my Trick RC Zagi-400, those taken from the Twinstar are much easier and more pleasing to watch. What's more, since I'm usually throttled back during an AP flight, one 3000 mah battery gives me over 20 minutes of flight time (see **Photos 4 & 5**).

Click here to watch video footage from the Twinstar/Aiptek duo.

Photo 5: The Twinstar passes overhead carrying the Aiptek camera. (James Lemon photo)

The only drawback to the Twinstar is its lack of landing gear. Hand-launching and belly landings are no big deal, mind you, but I'd prefer the traditional, wheeled departures and arrivals. I used to have homemade landing gear on mine, and I may reinstall it soon.

The Flip Ultra camera will also fit in the Twinstar, and I can position it to face forward or to either side. I'll try that combo soon.

So now we have good cameras, a good airplane, and we've captured some good aerial footage. Now what? It's time to *watch* the video, of course! And there are numerous ways to do this with either the Flip or Aiptek camera. In fact, I believe that most, if not all digital camcorders, have the same viewing options.

The quickest and simplest viewing method is to use the tiny LCD screen built into the camera. With the Flip you just hit the "Play" button and watch. With the Aiptek, just fold out the screen and put it in "My Works" mode.

I rarely leave the flying field without watching at least a little of the footage I've taken that day. And more often than not I'll have a few "lookey-loos" peering over my shoulder.

The next simplest way to view the videos is to use the included cable(s) to attach the camera to a TV. This is probably my favorite method, using an old 27" picture-tube TV. Those of you who've stepped out of the stone age and have a sizable LCD or plasma TV will be in for a *real* treat. At this point, of course, you're watching the raw, unedited video, so there are likely to be a few (cough cough) dull moments. And we're talking Ishtar dull here! Of some interest is that the TV cables included with my two cameras look to be the same, but they are not interchangeable.

Another way to view our blockbuster movies is on your computer. Sooner or later you'll do this for good reasons. First, you'll want to upload the videos from the camera to free its memory for shooting more videos. Secondly, you'll probably want to do a little editing to take your films from Ishtar–status to "The Blues Brothers" level (the undeniable pinnacle of American cinema). But we'll come back to editing in a minute.

Depending on the performance capabilities of your computer, viewing your videos can be pleasing or frustrating. Most reasonably powerful computers should have no trouble. The Ultra has a flip-out USB connector (hence its name), while the Aiptek includes a separate USB cable. Both cameras come with viewing software, but your computer probably already has default players for each file type. The Flip records .AVI files, while the Aiptek uses the .MOV format. What does this mean to you? Probably not much. And since those of you who care about such things already know the difference, I won't waste any more of your time.

As I said before, both cameras include software for basic editing. The Flip Ultra will automatically install 'FlipShare' software the first time you connect the camera to your PC, while the Aiptek includes a CD with "Total Media Extreme". Both applications basically work the same way, but I found the Flip product easier to use, and I really appreciate that it includes a few music selections that you can dub over your video. "Total Media Extreme" is more complicated because it has more editing features for customizing videos. I'm satisfied with the included software packages so I doubt that I'll ever invest in anything more powerful. But if you find the included programs lacking, there are tons of other software available for video editing.

Here's how I edit my footage. I first cut worthy segments from one or more videos and save each segment as a different file. Then I link each saved segment into one, larger file, The software also allows us to choose how to transition from one segment to the next, such as a fade-out and fade-in, or by wiping the screen. Then I'll add some text screens and sometimes music. For me, the most difficult and time-consuming process is choosing which video

segments to include. I also try to keep my edited videos to no more than two minutes long. I think it's best to leave the audience wanting more!

Both editing programs include options to burn your movies to a DVD so you can share your Emmy-worthy masterpieces with others. And since the videos are computer files, you can even share them over the internet. There are many websites that host videos for free, such as youtube.com and vimeo.com. These two sites claim the capability of hosting High Definition (HD) videos, but I've yet to explore that option. So far I've lowered the resolution of my HD videos to keep the file sizes reasonable, but I'll probably be uploading HD videos soon.

Shortly after I turned in last month's column, Gordon shot off an email asking which camera I prefer, the Flip Ultra or the Aiptek A-HD+ 1080P. Well, I had to think about that for a while. *(Editor's Note: I'm sorry, Terry. I didn't mean to hurt you.)* See, my reason for buying two cameras was to compare the video quality of a TV-resolution camera with an HD camera, and see if the latter was worth the difference in cost. At this point, I'll say that the HD quality *is* worth the higher price. Even at reduced resolution (for smaller files), the footage from my Aiptek seems clearer than that from the Flip.

On the other hand, the Flip Ultra camera has really impressed me. It feels more rugged and solid than the Aiptek, and I find it much easier to use. While it isn't exactly aerodynamic, I never have any trouble finding a way to mount the Flip on almost any airplane, which cannot be said of the Aiptek. Furthermore, the FlipShare software is so intuitive and much easier to use. Clearly, all aspects of the Flip Ultra were designed with the digital video rookie in mind (i.e., me!).

So if this were a head-to-head competition between the two cameras, and I were the sole judge, the Flip Ultra would edge out the Aiptek in every category but video quality (and the swimsuit competition). But we're talking about cameras here, so the 'video quality' score is very heavily weighted. I just wish Flip made an HD camera, because then.... Wait a minute! They do! In fact, they offer two different models in HD! The Flip UltraHD is essentially a Flip Ultra with HD resolution, while the Flip MinoHD is even smaller and lighter than the Ultra models!

Conceivably, the Flip MinoHD will provide the same user-friendly features I like in the Ultra, while combining them with video quality comparable to the Aiptek. And all of this in a smaller and lighter package. On paper, this appears to make the MinoHD seem the perfect AP camera. But since there's only one way to find out, I have one on the way and you'll be reading about it soon.

Folks, thanks for overlooking my diversion from purely electric aircraft topics these past two months. I won't promise to be *completely* devoid of AP chatter next month, but I will get back to the column's primary purpose, and serve up some good ol' grass roots electric hash.

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Two Old Scale Guys

by Dick Watz & Bill Hurt

D.W.: I mentioned to Bill the other day that I had found a long lost plane I designed and built back in 1985. The plane is a CSO, a straight-wing 1929 WACO with a Wright J6 7-cylinder engine. It was based right here in the center of God's country, Saginaw, MI.

B.H: You're a few hundred miles off, Dick, but that's a common mistake for people subjected to the bitter cold of the Great Frozen North.

Dick, some time ago you sent me some photos of that model and the full scale airplane with Don Tait at the controls. I'll see about posting some of them, since I'm sure the readers would love to see them. This is really a neat model complete with the under-cambered wings. I understand that the wings are actually held in place by the flying and landing wires.

D.W.: Hmm. When I told Bill that we were coming up on summer, he said he hoped it came on the weekend for us!

It seems to me that I read somewhere that the new WACO Classic was being built in Lansing. And the last time I checked, Lansing was still the capital of Michigan. The CSO was indeed owned by a gentleman named Don Tait, who was not only the proud owner of the CSO, but also a Piper Vagabond and a J-3 Cub.

My CSO once appeared on the cover of *"Flying Models"* magazine, and collected many first place trophies and one second place. It came in second place once because the judge said the paint was the wrong color, even though I'd painted it from the very same gallon can from which the full-size CSO was painted! Judges are great people, but after all is said and done, they're still just people. Bill says he's never been wrong as a judge, but he has been incorrect on occasion.

B.H.: I think what I said was that I might not always be right, but I'm seldom wrong.

D.W.: Well, I can tell you one thing, if any of you guys have ever met Janelle, then you know that Bill has an eye for the ladies. Bill and I both married "up." Sue, my wife, is a real sweetheart, as is Brian Winch's wife. Let me explain.

Brian called me after my open heart surgery, and his lovely wife knitted me a model plane that now hangs over the desk in my shop. I did some checking and discovered that it's a prototype of Australia's new front-line fighter. They are trading in their current fighter, the J-3 Cub, and building an all new jet-powered Cessna 150.

Anyway, the gift was very much appreciated. Thank you, my friends from down under. I'll put some pictures in the column soon.

B.H.: Well now, that was a smooth way to change the subject and get out of deep water, Dick. And since Brian has never offered to send me even a hungry Wombat, I'm not going there!

D.W.:"Prototypical". Remember that word. It means the same as or typical of the full-size plane or prototype. For example, my P-51 lands beautifully, which is typical of the full size airplane. It uses a wheel landing instead of a stall landing, just as the full-size often does. A wise man learns from others' mistakes.

B.H.: You're absolutely correct, because no one will live long enough to make them all by himself.

D.W.: If the full size airplane wheel lands, so should the model. If a model airplane is scale, it should display the same flight characteristics as the full size, so watch and learn. What do you think, Bill?

B.H.: Dick, I've been preaching that line for *years*. I've seen far too many model airplanes that do not fly in a prototypical manner, and that includes take-off and landings. Remember a couple of months ago when I was talking about those who do not use throttle management to fly at a prototypical scale speed? Well, that's exactly what I was trying to say. (We Southerners often make a few trips around the barn to eloquently say what those from the North would say in a few, dry words.) Non-prototypical flights often hurt your flight scores the most.

D.W.: Exactly. You don't take off straight up with a Cub, because it would not be prototypical. It isn't realistic.

But say, how are some of your projects coming along? Or as I call it, the projects from "geezer gulch". At least I *know* I'm a geezer, but I'm not so sure about Bill. I've seen Bill's YMF-5 project, and was awed by the beautiful workmanship, especially the dummy engine and seat. Both are true works of art. Bill has also designed and installed an in-flight adjustable stab. WACO's can use all the help they can get with adjustments, and that's a nice piece of engineering, Bill.

B.H.: Thanks, Dick. I've also been working on the fairings for the wheel pant to landing gear transition, and have found that there's a vast difference between what the original Waco's and the Waco Classics use. It seems that the early versions were built by different work crews, and they did not use an assembly line approach to building the aircraft. Instead they allowed the same crew to completely build each airplane, and thus the planes have different appearances, especially in the areas of metal work, and particularly in the fairings and things like cowl blisters. For example, one airplane would have a fairing of a different shape, and may even consist of a different number of pieces. Wheel pant fairings were especially different, with some being larger in height and length than others, while another airplane would have fairings that were deeper than another. These parts were usually made by beating aluminum sheeting with a rawhide hammer to form the basic shape, and then an English wheel was used to smooth out the hammer marks.

I found a fairly easy means of replicating the fairings on my 1/5 scale model, even though a buddy swears that they're too small. He's only built models of the Waco Classic, though, so what does he know?

I used a pair of picnic spoons (see **Photo 1**). I trimmed off the handle and the reinforcing ribs, and then sanded the spoon to the desired shape before cutting the slot for the landing gear. The

Photo 1: The makings of a fairing.

Photo 2: One spoon, cleaned up and ready to use

Photo 3: Bill's wheel pant fairing

gear cover will be formed to fit closely within the fairing, and should appear very scale-like. You can buy picnic spoons in various sizes, and you can also use some plastic Easter eggs to make fairings (see **Photos 2 & 3**).

Photo 4: Lonnie Johnson's wheel pant fairing

Photo 5: Lonnie's fuselage modifications

Lonnie Johnson is building a YMF-5 in 1/3 scale (that's right, 33%!), and he's laid up a very nice set of fairings that look just like those on the new Waco Classics that Dick mentioned being built in Lansing, MI (see **Photo 4**). Lonnie is also making some serious modifications to the bottom of the fuselage in order to make it appear that the fuselage continues smoothly along the bottom, rather than appear to have a bolt-on wing (see **Photo 5**).

D.W. Bill, I've received an email from a reader who has read that I like epoxy paints, and now he's asking about your favorite paint.

B.H.: I tried Hobby-Poxy years ago, and found it to be a good finishing material for models, but I still prefer the old fashioned Butyrate Dope over Nitrate Dope system. But for really nice finishes, I like to use an automotive

base coat and clear coat system. Most of the time I use DuPont products, but for the best red there's nothing that compares with the Sikkens brand paint. Of course, nothing compares to its price, either! Sikkens paints come from Germany, and is what you find on many expensive, European cars.

I've received some email, too. One was asking about the qualifiers for the annual Top Gun Invitational. Well, there *are* no specific qualifiers for Top Gun. This famous and highly prestigious scale competition is the brainchild of Frank Tiano, and he reserves the final word on who and what is be invited to compete. This is an international invitational event, so you need to earn an invitation. The best way to do that is to send Frank some professional-quality photos of your model, along with a set of documentation, and a letter describing your scale competition history. If Frank thinks you and your model are worthy, then you'll probably get an invitation. Frank is always seeking fresh faces and new models, and now is the time to approach him with your material to seek an invite for next year. Do *not* send amateurish photos. Get with someone who knows what they're doing with a camera, and then send prints large enough to show the fine details of your work.

Another email asked why we don't have any good BIY (build it yourself) kits anymore?

Actually, we do still have many fine BIY kits available. Balsa USA (see their ad in this issue) and Sig Mfg., for example, both offer some outstanding scale kits. Plus there are several fine companies like Precision Cut Kits who produce kits from your plans, and from plans offered by

Nick Ziroli Plans and others. Precision Cut Kits (see ad elsewhere in this issue) even has numerous pre-cut kits in stock!

No, we don't have *as many* BIY kits as we used to, for the same reason we don't have long, curly tails anymore. We didn't use them enough, so we lost them. The majority of modelers decided they wanted RTF's and ARF's more than BIY kits, so that's what the manufacturers produce and sell. Lesson learned - Be careful what you ask for because you just might get it!

Anyway, there still are a lot of good BIY kits out there. But if you can't find what you want, get a set of plans for something you like, and cut your own kit. Or have a professional kit cutter cut one for you.

D.W.: In a recent conversation with Bill, he reminded me that I'd brought up the subject of writing a column on sliding canopies. We are going to do that soon.

Say, did you ever notice all the cigar boxes so many scale modelers have? I used to think that all scale modelers smoked cigars, but I've discovered that all those boxes are their secret little stashes of pieces of wire, tubing, small parts from other airplanes, pins, wheels, and all sorts of add scraps of this and that. To a scale modeler, these boxes contain priceless treasures, and we all have them.

Now I'm going to turn you over to Bill while I go dust off my WACO CSO. I have plans for the CSO, and some day I hope to have plans for all the WACO's. I'll bring some pictures of the CSO next month, but maybe I can talk Bill into showing some more pictures this month of his Waco's seat, dummy engine, and adjustable stab. Gee, buddy, I hope I haven't put you on the spot!

B.H.: Oh no, Dick, you *never* put me on the spot! But we're out of space this month, with no room for more photos. I've already used some pretty good photos of the seat and dummy engine anyway, but maybe I'll come up with more next month.

I'm really impressed with the level of work Lonnie Johnson is showing on his model. So how about some of you guys sending us photos of what you're doing in your shops? And please include a brief description of the photo, and details describing your model(s) in general.

I like what Dick said about the cigar boxes, but I outgrew those years ago. I now use plastic tubs in various shapes and sizes, that you can find at most department stores and home supply centers. I have several full of great odds and ends that we accumulate over the years. Javelle, however, makes custom dolls, so I have to keep a close eye on my tubs to keep her from using all the best stuff in her work. I'm always amazed at what she can accomplish with just scraps of cloth and thread. I have a heck of a time holding on to my little paint brushes though. That's a lost cause.

-Dick Watz & Bill Hurt
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The Oily Hand

by Brian Winch

ANOTHER ONE FROM THE NORTH

Carl wrote with a problem, and did a fair bit of buttering up at the start of his letter. There's really no need for this because I will always reply, but you need to make sure your email software will accept my response. I get really annoyed when I spend valuable time thinking about your problem, often spending more time researching the answer, typing it out, hitting the Send button, and then getting an automated response telling me that the recipient's mail box would not accept my email address. All my work went down the drain. It's no better when I get a response asking me to re-send my address, or go and register at some other website, or fill out some kind of online form, etc. etc., just so your mailbox can decide whether or not I'm allowed to send you email. Well, forget it, mate! I don't have time for all that nonsense. When someone sends me a question, I'll attempt to answer it to the best of my knowledge, but it's up to them to set up their email software appropriately. When I spend a lot of time determining an answer and then typing it into an email, I do so because I hope it will help. But when nonsense like this occurs, the sender's name goes on my Black List, and unless they include some assurance in any future email that my reply will reach them with minimum hassle, names on my Black List get no response. *(Editor's Note: Amen. I've had the same thing happen far too many times, and one unwanted result of this is that we eventually "learn" not to spend a lot of time formatting a lengthy answer, since we can't count on it being received. I didn't keep a "Black List", though. Mine was called a Spit List... sort of.)*

Anyway, as I was saying to Carl, a bit of buttering-up is not necessary, but in truth it actually may result in a more desirable reply. (Ho, ho, ho! I'm joking, of course). *(Editor's Note: No he's not. When I need info from the Wiz, I find it necessary to use words like "devine master", "all knowing professor", and "undeniable expert of experts". Then after I get my answer, I'll send a sincere reply saying something like, "Thanks, you swamp water guzzling urchin of evil and prince of kangaroo lingerie atrocities." Then he responds using several dozen Oz-peculiar phrases that send me scurrying for my autographed copy of his best-selling book "The Official Guide to Australian Outback Animal Pornography".)*

I really do appreciate the nice comments, sort of a pat on the back for a lot of time spent in front of this bloody computer screen, when I could be out on full moon nights, adding to my vast collection of Wombat pelts.

Anyway, Carl asked about any problems that might crop up concerning accumulated oil in an inverted 4C engine. He recently purchased a Saito FA-82 (a nice engine) to power his latest creation, but he's concerned about oil accumulation inside the inverted engine. He asked about my modification for the engine.

Carl, the accumulation of oil in an inverted engine is generally not a concern because pressure blows most of it out, and anything left sits in the underside of the piston which is much better than the sump as in an upright engine, because the piston has no ball bearings to corrode. You should be aware, however, that some oil will get past the piston over time, and sit in the combustion chamber and/or glow plug

Photo 1: In the head of O.S. Alpha engines there is a small funnel drilled just left of the inlet valve (closest to you in the photo) for the oil to be directed back into the combustion chamber.

Photo 2: From the crankcase the oil is driven up oil galleries in the cam follower housing guides.

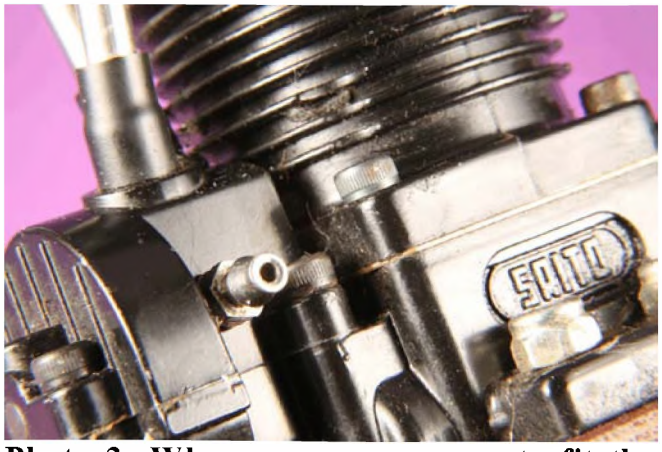

Photo 3: When you measure up to fit the nipple, make sure you can fit a socket spanner in to tighten it.

cavity. This could cause hydraulic lock and severe engine damage if you *force* the issue. At the start of each flying day, turn the engine by hand several times to make sure the piston will go up and down without hydraulic locking at the top. If the compression is noticeably higher than usual, due to oil in the combustion chamber, turning the Propshaft backwards is a good way of clearing it. I urge you *not* to remove the glow plug (except as a last resort) since you wear the threads in the head by doing so, and increase your chances of stripping those threads. For sure, you can have a steel heli-coil fitted if the threads do get chewed or severely worn, but this is not something you'll do at the flying field, and it costs money.

Also keep this in mind: *Never* apply an electric starter to *any* engine, until you have turned the prop several times by hand to make sure it turns as it should.

Anyway, the nipple in the cam case is a good idea, as it guarantees oil into that area. Connect the nipple to another nipple in the intake induction tube, and you'll have the perfect "Winch th' Wiz's" oiling system. Oil then goes where it's needed, and is later sucked out to be re-ingested through the engine. I think the Saito engines are probably the only ones now that still have a breather to the atmosphere. Nearly all the rest are using some form of closed loop system (see **Photos 1 & 2**). If you have any problems with any of this, feel free to contact me again (except on full-moon nights).

My reference to the nipple in the cam case was in reply to Carl asking if such was feasible. I'm in favor of this closed loop system, and I've written about it many times. To remind you, a nipple is threaded into the cam case (see **Photo 3**) or just behind the front bearing, and this nipple is connected via fuel line to another nipple fitted into the intake tube (see **Photo 4**). If the intake tube is cast aluminum you can drill and tap a hole for the nipple. A chromed (generally copper) tube will require a soldered or chemically welded nipple or fitting. You can solder a nipple or a short length of metal tube

Photo 4: It's a lot of work to silver braze the nipple, and much easier to use a metal epoxy.

Photo 5: I use a lot of Devcon products, and I still like J&B Weld. It does a good job but you have to be quick with the 4-minute product.

Photo 6: The lovely Laser engines from the UK are popular with scale modelers.

in place, but be careful of the soldering process. Chrome or nickel plating can be a real bother at times, depending on the flux you use. Silver brazing, however, should be no problem.

I carefully punch a dimple and small hole into the tube (the position is not important other than making sure there's no interference with the throttle, so "check first, drill last") using a sharp, center punch. This gives a good purchase point for a thread and solder. I tap a thread suitable for the nipple, thread it in, and then solder the them together. I do much the same if I silver braze the job. Your main consideration is that the engine may require disassembly if you want to fit the nipple in a tucked-away position. There's also a fair chance that the manufacturer may no longer honor your warranty.

Since sending my reply to Carl, I've done away with the solder and brazing altogether, as it's time consuming and costly when doing a customer's engine. I now fit the nipple as described, but cement it in position with Devcon 60 minute metal epoxy. It's neat, efficient, and looks good if you take a little care (see **Photo 5**).

Carl also wrote that he has a little drain tank attached to the breather of an O.S. FS-52 in his "Lanzo Bomber". After six flights, using 90 cc of fuel, he's surprised at how much oil was in the drain tank! Well, Carl, if it's coming out of the engine, then it's going through the engine, and that's exactly what we want! If you want to see some really good displays of oil efflux from a breather, try a Laser engine! The oil *really* pours out the rear breathers of them, and these engines last so long they can become a family heirloom! (See **Photo 6**.)

YOUR NUMBER IS UP!

Here's a little Ozzie story to make you feel all warm and fuzzy.

Danny, a good friend of mine and a well rounded aeromodeler from Victoria (a deep south state between NSW and Tasmania) comes up with some wild and exotic ideas at times (actually, *all* the time), and he loves flying to extremes. He's also a computer genius who actually *balances his* CD's and DVD's to ensure smooth running when they're being spun at very high speed. Anyway, Danny was telling me how important it is to provide a contact address on a

free flight model (on any model, actually) in case of a flyaway. In the 1984 Nationals he was flying a high performance free flight model powered by a very rare and extra hot engine. The model flew "O.O.S.", which to non-free flighters means it was lost.. flew away... buggered off into the distance... "Out Of Sight." Well, in late June 2002 a modeler saw that same model at a "Bring & Buy" sale (it was slightly damaged), so he told the prospective seller (who had been given it by a non-modeler finder) that it could be traced by the MAAA (our version of your AMA) number on the wing. A quick call to Barry Lee, then secretary of the Free Flight Society, and Danny's name was provided. Shortly thereafter the modeler and his model were reunited, and they both lived happily ever after. Brings a tear to your eye, doesn't it?

STRONG ARM METHODS

A little engineering explanation may be good before we begin this next discussion. Terminology has been stuffed-up a bit over the years, so it's sometimes pretty confusing. In simpler days a bolt had a constant diameter body and was mainly for metal fastening. A screw had a tapering diameter body and was generally used for woodwork or sheet metal... all nice and simple. Now we have bolts called screws, taper-thread screws for metal, and self threading fasteners that will screw into almost anything. Carpenters are now wood workers, and metal workers have *dozens* of classifications. I once had a dog I called "Carpenter." Why? Because if I kicked him in the butt he'd make a bolt for the door!

Anyway, to clear some of the fog, it would now appear that a fastener with a constant diameter body with the thread going all the way up to the underside of the head is a "screw", and if the thread goes only partway, leaving a non-threaded section under the head, then it's a "bolt." I tell you, it's enough to drive a guy... well, "nuts" is an altogether different problem we'll discuss some other time. But for now we're happy with "bolt" and "screw."

ON TO THE PROBLEM

This is a reasonably common problem according to the number of calls and letters I receive for advice. When tightening or loosening a cap head bolt (or screw) (the type with an internal hexagon hole into which we insert an Allen key or hex wrench), and we're using a ball-tip driver, the ball end breaks off in the hole and cannot be coaxed out. Then how do we remove the #@&% bolt? Well, first off it won't help to use bad language. (I'm not saying it isn't justified, I'm only saying that it won't help!) Just remember, it was you who used the strong arm method and broke the bloody thing off (heavy with arm, light in the head).

Anyway, here's a letter from a modeler who had this problem. (Don't worry, Glenn, I won't use your name and cause you a lot of embarrassment. By the way, is your dad still active in modeling? A lot of us old timers remember Tort Lynes as great speed flier in the early control-line days, as written up in the Hall of Fame for all to see).

Dear Brian,

I hope you can help me. About six months ago I noticed that my trusty old Saito FA-65 was in need of new bearings. While disassembling the engine I'd removed all the bolts except for one stubborn bugger in the cylinder base. I leaned a bit heavy on the ball driver when I heard a snap that I assumed was an indication that the bolt had come loose. But no, it was still tight and now had the ball end of the driver stuck tight in its head socket. I swore at it a lot and tried various implements to remove the ball, but it seems now a permanent fixture. Oh well, maybe the bearings weren't so bad after all. So I replaced the other bolts and continued to use the engine. Well, the engine has now seen even more air time, and the extra noises are begging me to replace the bearings. So how can I remove the bolt with the ball stuck in it?

Glenn

Of all the possible engines, it just had to be an early Saito. In the early days, Saito must have used retired Sumo wrestlers to assemble their

Photo 7: Small vice grips will do the job nicely if you set them correctly, and if they will reach the bolt.

engines and tighten the bolts. Nearly all were a fight to loosen. So, a long time back I asked the importer to relay the problem to the company, and suggested that they try disassembling an engine themselves. I never heard back from them, but it wasn't long before the bolts were less of a hassle to remove. Many of the older engines, however, remain in use and the bolts are still extra tight.

Lesson Learned: *Never* use a ball driver to loosen a stubborn bolt. Ball drivers are made for rapidly spinning the bolt in or out, not for loosening or final tightening. Use a standard (or in some cases a shortened end) Allen key for the heavy-effort part of the job. If you have the same problem with a bolt recessed into, let's say a cylinder head, then you have a *real* problem as the broken ball tool doesn't take kindly to drilling unless you use a carbide drill bit (which is very hard and will break easily), or you attack the ball head with a Dremel-type tool using a grinding stone or abrasive cutting disc.

My reply to Glenn was... use a very small pair of vice grips set to clamp tightly on the bolt head (see **Photo 7**). Once tightened in place, you can usually undo the bolt. If that doesn't work, you can sometimes use a cutting disc to grind a slot for a flat-tip screwdriver. But when all else fails, cut or grind the head away with that motor tool and a cutting or grinding bit. Then when the parts are separated, remove the stub of the bolt with vice grips. One thing is for certain, you'll then need a new bolt (and a new ball driver).

Here's a brief explanation about how the problem arises, and a warning from days past (for me, that is). When tightening bolts to hold parts together, and particularly when working with aluminum parts, never do the final tightening while the parts are hot. When the metal parts cools they contract (shrink a little), and often leave the bolts loose. On the other hand, if the parts are cold, and particularly when they're new parts, don't over-tighten the bolts. Most alloys, and particularly aluminum, expand to some extent when they heat up. If you over-tighten the bolts and the alloy expands, the joint(s) become super tight and, in extreme cases, can actually strip the thread. At the very least, when you attempt to remove them, the job is extremely difficult and, in some cases, destroys tools or the bolt(s). What causes amazement to some people is that when the heads are cut or ground off and the parts separated, the remaining stub of the bolt can sometimes be removed with your fingers. It wasn't the threads that were tight, it was the expanded metal pushing against the bolt head. It takes a little experience to "guess" at the proper torque when you don't have the manufacturer's recommended torque specifications.

YAHOOIE!

Yes, that was the last sound I heard from Jughead, the fractured-brain assistant who haunts my days. In his never ending quest to conquer flight (without the aid of conventional aircraft, mind you) he recently came up with an incredibly weird idea (I don't know *where* he gets this). I was writing an article about very early weaponry and the development of the trebuchet (pronounced, tray bu shay'), a form of giant slingshot used in sieges of castles, compounds, and walled communities. In its simplest form, a long, pivoting arm had a great amount of weight on one end while the other end was tied or latched close to the ground. The un-weighted end had a large bucket or bowl into which missiles (like disease infected animals, large stones, pots of burning tar, etc.) were

placed. On command, the latch was released and the weight plummeted toward the ground, in turn hurling the missile in the bowl (often great distances) into the area under siege. The use of diseased corpses was likely the first use of biological warfare. Well, except for warriors who hadn't bathed in months.

Anyway, "juice for brains" read what I'd written, and soon after came up with his new brain storm (i.e., dark, cloudy, and undesirable results). He constructed his own, incredibly huge trebuchet out in the backyard, using a large truck load of scrap metal as the weight. Then he had Tru-Turn make up a monster-size aluminum spinner, in a pylon racing shape, to fit on his head for its streamlining effect! Next he ordered 10 kilograms (22.1 lbs.) of rocket powder from the Estes rocket company, which he stuffed into a long, aluminum tube which he'd fitted with a fuse and a leather harness he could strap on his chest. Then he spent an entire day making a large delta wing to strap onto his back, and a smaller one with a vertical fin and brackets into which he could fit his feet. His idea, it seemed, was to sit in the trebuchet's basket, light the wick for his rocket motor, release the trebuchet's latch, and fly off... somewhere. He planned on using the delta wings and the fin to control his flight.

Well, his first problem came when "someone" replaced the scrap metal weight with solid lead weighing about 200 times the original weight, and then added a few pounds of Roman Candle powder to the rocket. With all preparations completed late one evening, and a nearby tape recorder loudly playing the 1812 Overture, he took his seat in the basket, lit the fuse, and released the catch.

Talk about acceleration! He left the basket so quickly, and at an angle of about 60°, he was

around 1,000 feet high before the rocket cut in, after which he became a long-tailed comet heading high over the horizon. One might think of the "Rockets' Red Glare", but he was surely a blaze of "Stars and Stripes" heading into space. As he went over the Ozark Plateau, a small band of anti-US insurgents hiding in a secret enclave saw the blazing sight, tore off their hats, placed their hands on their hearts, and pledged undying allegiance to the U.S. of A. Moments later he whizzed over the Ural Mountain in western Russia, where a fully armed pursuit jet fighter took off from a carrier in the Caspian Sea to engage the intruder. The rocket motor, however, burned out long before the pilot got even close.

In a TV news report the next morning, we heard that several space observatories were reporting sightings of a strange disturbance on the moon, describing it as a "dust explosion", much as if a foreign body had fallen into a dust crater. I don't know anything about that, but while I was enjoying a bit of peace and quiet, I decided to descend the dark stairs into my secret, underground work shop.

APRILWUN DOT ROT DOT CON

This section is devoted to strange ideas, under-developments, and temporary departures from sane thoughts. *Warning*! Note very well that these ideas will incur a major risk to your bodily functions, your family history, your favorite bassoon, and maybe even your pet Rhynockerdile *(Ed: a species so rare only Brian has ever seen one, and he ate it!)*. Before even *considering* trying any of these ideas, you should discuss the matter with your dental health professional, your brain surgeon, several local trash collectors, and anyone who might also be stupid enough to think this is real. In other words, this is all nonsense, not a project you should (or even could) actually attempt. Do not believe anything you read and/or see below this warning, for nothing here is any more real or wholesome than editors (other than me, that is).

Now, for modelers who like something out of the ordinary... something with which to draw attention at the flying field, I have developed an all new and super twin engine, the like of which has never before been seen. Being so different, of course, this will require a somewhat different aircraft, and something with a strong, pylon-type mount above the wing, capable of handling the power of the two engines you select. Really, this is so simple I can't imagine why no one has done it before! It doesn't even matter if you use engines of different capacities, as long as both have the same diameter crankshaft, and one will run in the opposite direction of the other.

Make up two pylon mounts about 1/2" higher than half the diameter of the propeller you'll use. Mount the engines so that the threaded end of each crankshaft touches the other in perfect alignment (you may need shims under one engine to achieve this). Then move one engine back and wind a prop nut onto each shaft. Then add a suitable propeller with a prop washer on each face. Fit the prop onto one crankshaft, and after carefully aligning the engines, tighten the mounting bolts. Turn the shaft of one engine so that the piston is at the bottom of it stroke, and set the other at the top of its stroke (for a balanced twin effect). Now align the prop at the joint where the two crankshafts meet, and tighten both prop nuts against the prop to strongly secure it in place.

Starting the engines is the next step, and take care here since it has to be done by hand. I don't

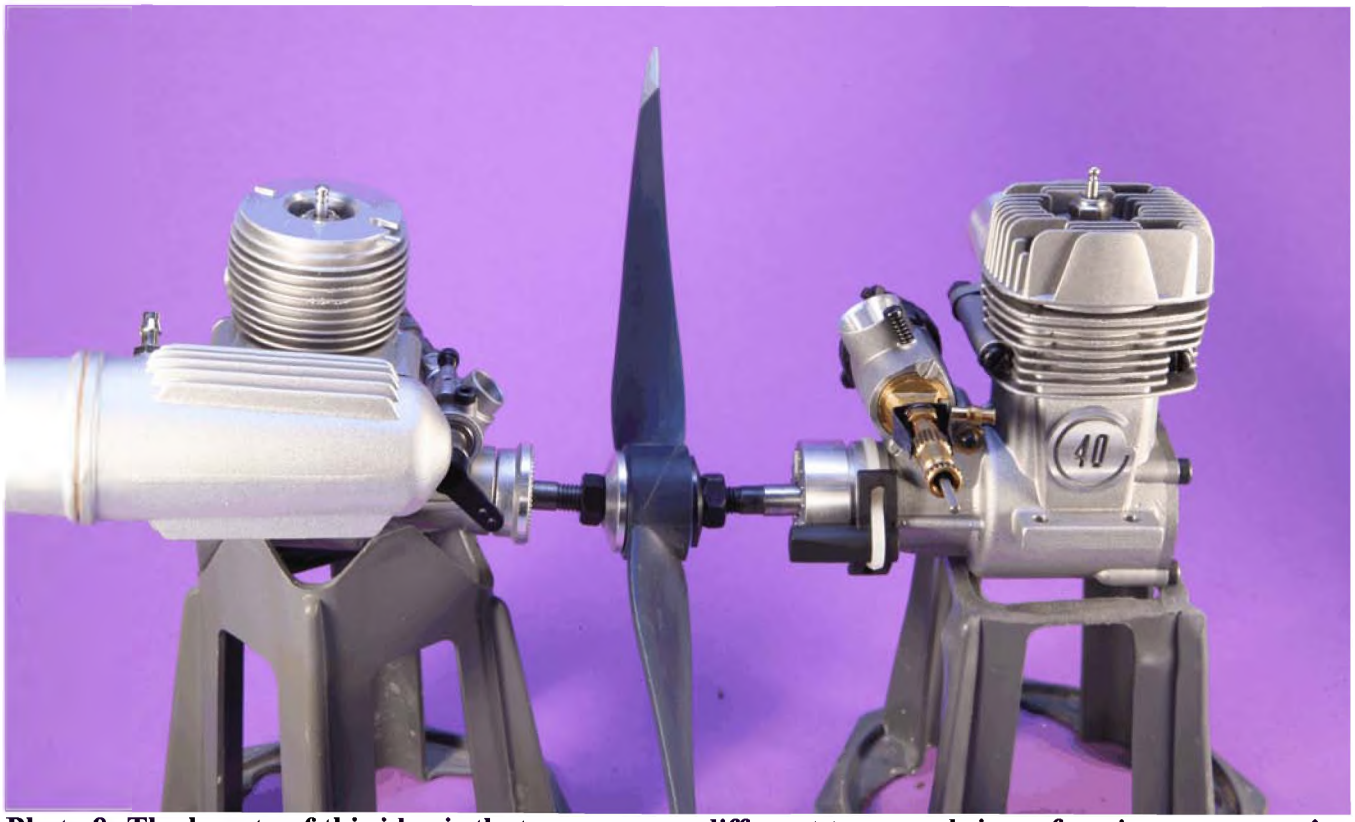

Photo 8: The beauty of this idea is that you can use different types and sizes of engines or motors!

think you can get an electric starter in there unless one engine has a rear starting cone, or you devise a belt-drive system. And once the engines are running, go slowly when setting the fuel mixtures because you want both engines to sing in harmony.

I guarantee your model will raise eyebrows at the flying field, and just imagine the sound of those two engines screaming together (see **Photo 8**). Oh well, it's just one more absolutely stunning idea, from Winch - the well seasoned Wiz. *(Editor's Note: I can't help but find it ironic that even though Brian may not be familiar with the American slang, "Taking a wiz", it is nevertheless amazingly appropriate.)*

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How did this odd animal come to be? Think about it. The duck-billed platypus is found only in Australia, and Brian Winch lives in Australia. So now, what was the question again?

The Webb Scale

by Gary Webb

Hello again, scale builders and fliers. It's the middle of July as I write this. By the time you'll read it, the flying season will be winding down for many of us here in the North, but I guess it will still be going strong for those of you in the deep South. I have a great story to tell you this month, about one of my flying buddies and best friends, the guy who taught me how to fly, what now seems like a hundred years ago. Joe Hahn and his son Terry are producing an amazing scale model of the famous radial engine and turbine powered "Jimmy Franklin Waco Mystery Ship" (see **Photo 1** below). Joe and Terry have been building and flying scale war birds and aerobatic aircraft for many years. Terry has grown through the ranks of aerobatic pilots to the level that has him flying at the annual Extreme Flight Championships! He also

flies UAV's for the military over in the Mid-East as a contractor, but if I say any more about that, he'll have to kill me and you. Joe has personally inspired me to continue progressing in my building skills for many years as an example of a consummate scale builder. Joe is part owner of

Photo 1: Terry and Joe Hahn with their Waco Mystery Ship, featuring both a gas engine and turbine

Photo 2: Carbon fiber inner landing gear leg with balsa outer skin

DJ Aerotech, known for their light weight and great flying competition sailplanes and small electric scale models.

Jimmy Franklin was noted in particular for two aircraft that he flew. One was the Waco Mystery ship, a highly modified UPF-7. The other was an all black, twin engine Aerostar named the "Starship Pride". I've been privileged over the years to have seen him perform in both aircraft. In fact, I once had the pleasure of meeting Mr. Franklin, many years ago at Ida Grove, IA, during the Byron Originals fly-instructions. He even signed my pilots log book, along with seven times unlimited aerobatics champion, Leo Loudenslager during the same event. I used to fly out there every year and work the flight lines. I hung out some of the times at the airport across the street where my plane was tied down, so as to be able to meet and talk with the full scale show pilots. Ah, those were the days, and now you know why this project is so exciting for me.

Now here's my interview with Joe and Terry Hahn, along with several construction photos. I was honored to see this model fly recently at the Celina, OH, giant scale fly-in. It turned out to be a most memorable day for a lot of reasons, so stay tuned. Meanwhile, You can read Jimmy Franklin's story at the following websites:

www.airspacemag.com/flight-today/extreme_airshow.html

www.airportjournals.com/Display.cfm?varID=0509005

GW: What were some of the challenges you faced in building this aircraft?

JH: In order to compete at the XFC, the weight of the plane had to be 55 lbs. or less, so Terry's choice of components was the first challenge, and he did very well.

Then acquiring documentation on Jimmy's version of the UPF-7 was tough. My friend Joe Balmer provided me with some very helpful 3-views, plus we managed to find a number of photos of the jet Waco from various sources, mainly on the internet. Between these two sources I was able to piece together the bulk of the info needed to accomplish the project.

Some other notable challenges include the landing gear (see ***Photo 2*** *above). The AMR kit came with beautifully formed aluminum landing gear legs that were, unfortunately, absolutely useless for this project. Terry found a set of very nice and very large composite legs that readily adapted to the project. This provided a big weight savings with this mod, too. Of course the entire area of landing gear attachment had to be altered to adapt the legs for proper position on the fuselage, and for security.*

Photo 3: The turbine engine and its mount, under the Waco's fuselage

There were some major challenges in mounting the jet engine and insulating the fuselage from heat damage. Our main goal was to create hard mounting points in the lower nose area of the fuselage to mount the engine. Visions of the jet engine falling off the airplane in flight scared me, so a total effort here was crucial. It basically involved using plywood formers sized to engage the basic plywood box structure of the fuselage, and aluminum angle gussets and rails which were secured to these bulkheads, with the jet engine ultimately secured to the rails via more aluminum stock (see ***Photo 3*** *above). Boy, did that make a long story short!*

Aircraft Spruce Co., a components supplier for full size home built aircraft, had materials designed for insulation that served our purpose perfectly. One was a thin blanket of special material capable of blocking heat on the order of 2,000˚. It was not particularly heavy, either, so I used it in areas where I felt there would be exposure to the highest temps, along the belly of the fuselage. This material was also used as an inner liner in the real hot spots, over which another layer of high-temp, self adhesive, and reflective material was placed, secured around the edges with small wood screws. After about 18 flights or so, these materials are holding up well.

For the tailpipe, a company called Tamjets made this item a breeze. They're a custom manufacturer of just such things, so I faxed them a quick sketch of what we needed, and a handful of days later we had our custom tailpipe! Securing it to the fuselage in the scale position was a bit time consuming, but I already had brackets in place based on the sketch, so that too went fairly quickly (see ***Photo 4*** *on the following page).*

The standard WACO had dihedral in both wings, but Jimmy's Jet Waco had a flat upper wing. Modifying the kit's wing required elongating the holes in the ribs for the wing tube, and filling the elongated portion of the

Photo 4: Here you can see the turbine's custom-made tail pipe

hole with balsa and/or lightweight fillers. Flattening the upper wing resulted in the two wings being a bit closer together in the area of the N-struts, but since they're custom fit anyway, this actually went pretty well.

Knowing that this big bird was going to be put through some serious aerobatic paces, the wing structure required some special attention for strengthening. I had some special spars cut a little undersize so carbon fiber caps could be bonded to bring the spars back to their original size, but much stronger. We also used some special shear webs built up from vertical grain high density balsa, with a layer of 45° fiberglass laminated on either side to handle the increased load I knew the wing would face. All this structure was tied together with a wrap of lightweight fiberglass tape which essentially directly connected the spars to the shear webs. I figure the weak link in the wing is now the wing tube, but it's a pretty big tube, so I'm happy with it.

GW: How much of the model was changed to conform to the scale outline of Jimmy's modified aircraft?

JH: Some areas required significant changes, while others needed no change at all. The most significant changes were in the vertical stab and rudder shapes, and the upper fuselage shape (see ***Photo 5*** *on the following page). Good views were a huge help in re-shaping the vertical stab and rudder. I used basically the same structure as the kit, but enlarged and re-shaped the parts. I also added internal hard points for the external tail brace wires. Hard points were also added to the aft fuselage bottom for extra cable bracing formed from aluminum stock.*

Photo 6: The Waco fuselage in the bones, showing changes made to match the Waco Mystery Ship

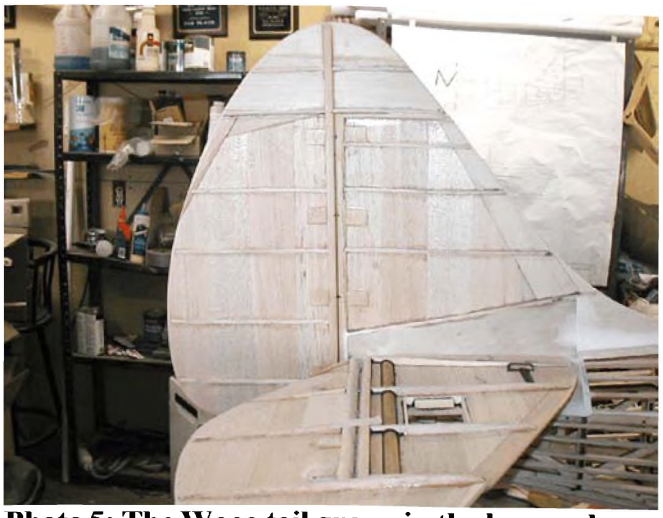


Photo 5: The Waco tail group in the bones, showing Joe's modifications

The upper fuselage required complete re-contouring to the proper shape. This involved total replacement of all of the upper fuselage formers. Included in this operation were the things required to move the cockpit aft by approximately one bulkhead position, and creating a revised turtle deck to match the jet Waco's shape (see ***Photo 6****).*

The Jet Waco also had one extra cabane strut in the aft position, requiring fabrication of a fourth strut on each side, and associated cable bracing back to the aft rear position of the N-struts on the wing. Internal bracing across the width of the fuselage internally for the purpose of tying the cabane struts together for load-carrying was required at each cabane strut position. These cabane struts were going to be working overtime on this model, so connecting them all across internally for load-carrying was absolutely necessary.

GW: What covering and paint did you use?

JH: Black Solartex was used for the covering. I love that stuff. Then latex paint was used where paint was required, wherever silver and red appeared. We also used some black latex on the fiberglass pieces, like the cowl and wheel pants. Automotive clear-coat was used over the latex on the cowl, pants, and hatch.

GW: What was the final weight of the completed model?

JH: Our goal of less than 55 lbs. was tough to achieve, but we did it. It weighs 53 lbs. In fact, if I'd sprayed the entire model with automotive clear-coat, it would have gone over. That's why the entire model is not high-gloss.

GW: What radio and servos were used?

JH: A JR 12X transmitter and 20 or 30 JR8711 servos... I lost count. (Actually I think there are 10 of them). We equipped the model with two completely separate receiver systems,

Photo 7: They have to start the turbine engine first, because the prop wash from the gas engine causes the fuel-air mixture to be too lean during turbine start up.

with each controlling about half the plane. This way we can completely lose one entire system and still get the bird home. By the way, we have five switches; smoke battery, jet ignition, piston ignition, and two receiver batteries.

GW: How much fuel does it carry?

JH: It carries 40 oz. for the gas engine, 105 oz. for the turbine, and 40 oz. of smoke liquid.

GW: Wow, what a great model, Joe. Thanks for letting us see it, and thanks for your time.

Surprise! Here's a link you can go to and see this incredible model actually fly.
Www.myspacetv.com/index.cfm?fuseaction
=vids.individual&videoid=59427776

As I mentioned earlier, I've already seen the model fly, and it was awesome! They have to start the turbine engine first, because the prop wash from the gas engine causes the fuel-air mixture to be too lean during turbine start up (see **Photo** 7 above).

Terry spent many hours watching films of Jimmy Franklin flying the Jet Waco, so he could emulate the late Mr. Franklin's air show. He also spent many hours practicing on his flight simulator to get it ingrained into his memory before flying the model. And after watching Terry fly it, I can tell you that his practice paid off big time! I thought I was watching the full scale aircraft! At the end of his flight, Terry sometimes shuts the turbine down and flies only on the gas engine, while at other times he does just the opposite. It flies quite well with either engine, but seeing this huge model going vertical with both engines at full power is simply mind blowing.

(Continued on next page)

Photo 8: Ron Ballard and his new A-10 Wart-Hog

Photo 9: Close up view of the pilot and cockpit detailing

At the same fly-in was Ron Ballard's huge A-10 Warthog as seen in **Photo 8**, built from a Mibo kit, with two Wren 160 turbines providing a combined thrust of 70 lbs. The model has a 10' wing span, and weighs 56.4 lbs. dry. The detail work (see **Photo 9**) and weathering was fantastic! Also awesome was the way Ron flew this plane, so scale-like it was hard to believe it wasn't the full scale aircraft flying overhead (see **Photo 10** on following page). Fantastic realism!

Also there was Jeff Holsinger (known as "Mr. Gadget") flying his very impressive 1/3 scale Pitts Python powered by a Jetcat turbo-prop. The model has a 100" wing span,

Photo 10: Here's Ron's A-10 coming in for a low pass across the field.

and weighs 36 lbs. Jeff really adds to the realism by performing the same aerobatic maneuvers that the full scale plane can do (see **Photo 11**).

Jim Martin was present with his old favorite, a Top Flite Gold Series Mustang. Jim is our AMA District III Associate VP, so he tries to

Photo 11: Jeff Holsinger and his Turbo prop powered scale Pitts Python

Photo 12: Jim Martin with his Fuji 50 powered Top Flite Mustang.

Photo 13: Joe Hahn and his beautiful Corsair

attend as many of the events in his district as possible (see **Photo 12**). Joe Hahn also brought along his trusty Byron Originals Corsair, that's beautifully weathered, as you can see in **Photo 13**. Jim and Joe also put on a great show of flying in formation. This is something a lot of scale war bird pilots are doing now. It takes a lot of skill and practice to pull this off convincingly, though.

I'll be off to the Scale NATS in a couple of weeks, posing as a mild-mannered reporter to get all the latest happenings and photos from the exciting activities there.

Whew! That was a lot to report this month! I hope to see you again next month, and in the mean time, don't forget to send us photos of your scale projects, so we can share them here with everyone. Remember we motivate each other to improve our modeling skills.

Fair winds and blue skies to all.

-Gary Webb
gcwent@woh.rr.com

FUN AEROBATICS

by Ed Moorman

MANEUVER OF THE MONTH

OUTSIDE SQUARE LOOP

This month we're continuing with the loop sequence of maneuvers. You may recall that we earlier learned the Reverse Outside Loop, which begins upward, then the Outside Loop, which starts off going downward. Last month we did Reverse Outside Square Loops to get you ready for this month's scary one, the "dive-at-the-ground and tuck under" Outside Square Loop. This is one of my favorite maneuvers. I love to get right out in front and hit down elevator to go screaming toward the turf, then hit down again to tuck under for the inverted leg. The climb back up and the final leveling off back on top are anti-climatic... it's that first "dive and tuck" that people notice. Not many people do outside squares, so it tends to stand out when you do them.

Here's a secret about this maneuver (but keep it to yourself), it's really not hard to do an Outside Square Loop, it's just intimidating to the inexperienced. If you've gone through our sequence of maneuvers, first learning reverse outside loops, then the downward outside loop, then the square inside loop, and then the reverse outside square loop, then you should be ready for this one.

DESCRIPTION

The Outside Square Loop is a square cornered loop that begins from level flight, with the airplane pitching downward toward the earth. The second corner puts the plane into level, inverted flight. Corner three aims the plane back upward, and corner four levels it out back on top, completing the maneuver.

KEYS TO SUCCESS

The primary keys to successfully doing an Outside Square Loop is to have a plane that won't stall, snap, or roll off sideways during a

down elevator square corner, and then building up confidence in your airplane and yourself. Learn the sequence of looping maneuvers and you won't have any trouble.

AIRPLANE SETUP

"Don't overdo the down." Remember, you don't want your plane to snap, no matter how hard you apply down elevator. You should already have determined the correct amount of elevator from doing the reverse Outside Square Loop covered last month. You don't need 3D-type rates, either. I use about 1/2 to 3/4 down control for my outside squares.

WHAT AIRPLANE TO USE

Stick-type models are usually great for Outside Square Loops. Their high wing and low tail setup gives good down control, so they do outside squares very well. I have several Sticks, including the Ultra Stick 40 and 60, and the Wild Stik 40 and 120, and they all do great square loops, inside and out. Any 3D plane is fine, of course, as well as any plane with a fairly thick and symmetrical airfoil. Planes with semi-symmetrical airfoils as well can normally do good Outside Square Loops. This group includes the Sig 4-Star series and even many advanced trainers. In particular, the World Models Sky Raider Mach I (a high wing advanced trainer) is another good plane. I've done Outside Square

Loops and square eights with this model many times. This is not, however, a good maneuver for trainers with flat-bottom airfoils. A plane with a flat-bottom airfoil can do an inside square loop just fine, but due to that flat-bottom wing, outside maneuvers are difficult at best. A semi-symmetrical or fully symmetrical airfoil is much better.

RC REPORT MAGAZINE

TEACH YOURSELF AEROBATICS CARD

OUTSIDE SQUARE LOOP

By Ed Moorman

SAFETY FIRST: Square loops put a lot of stress on your wing and can cause it to fail in the middle. Be cautious. Check your plane first.

DESCRIPTION OF THE OUTSIDE SQUARE LOOP

The outside square loop is a square cornered loop starting from level flight with the plane pitching downward toward the ground.

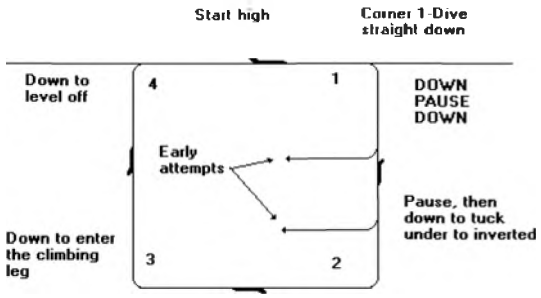
KEYS TO DOING THE OUTSIDE SQUARE LOOP

The key to doing an outside square loop is to have a plane that won't stall, snap or roll off in a down control square corner and building your confidence in your plane and yourself.

AIRPLANE SET-UP FOR DOING THE OUTSIDE SQUARE LOOP

Don't overdo the down. Remember, you don't want your plane to snap no matter how hard you bang the down elevator. You should have the correct amount of elevator set from doing the reverse outside square loop covered in last month's issue. You really don't need 3D down elevator. I use about half to three quarters down control on low rate on a Stick and get nice corners. Speaking of Sticks, they are great planes for this maneuver. The high wing and low tail set-up gives good down control authority.

OUTSIDE SQUARE LOOP DIAGRAM



STANDARD SET-UP

Full power, parallel to the runway, TWO mistake high. All loops are best done INTO the wind.

DOING THE MANEUVER

First check your plane. You'll probably be hitting full down elevator whether you need it or not, so be sure your wing is strong enough to take the stress.

You need enough down elevator authority to make those square corners. A lot of people don't set up their models with a lot of down elevator, figuring they won't need it. Well, for outside squares you'll need it! And try to set up the authority (overall response) the same for both up and down elevator.

Finally, we need to do some in-flight testing to determine your final elevator setting. Last month we covered the reverse outside square loop where you roll inverted first, then start your square corners going upwards. You need to learn this maneuver first. Once you can do the square corners well in a reverse outside square, you'll do fine with the diving outside square. You should also have corrected any snap tendencies your plane had.

For a test, take your plane up and do a reverse outside square using full down elevator. If the plane doesn't snap in the corners, the controls are good. When the "pucker" factor goes up, we all have a tendency to overdo it somewhat and use full down. I remember when I did my first Outside Square Loop. I was so afraid my Kaos wouldn't make it, I think I started about a thousand feet up and I probably bent the elevator stick on the "dive and tuck under" number two "coffin corner." This is why we need to practice the reverse outside square loop first. We need to get a feel for the turn radius of our airplane, and then build up our confidence so we can better determine what altitude to begin the maneuver, and where to execute that diving, tuck under corner.

As usual we'll start with the standard setup, but make it a little higher (about *two* mistakes high) at first so you're confident that you have plenty of altitude. Later on you'll be surprised at how little altitude you really need.

STANDARD SETUP

1. Full power
2. Fly parallel to the runway
3. Begin from about *two* mistakes high.

The Outside Square Loop should begin while flying upwind.

WHAT TO DO

Fly by in front of yourself (two mistakes high), take a deep breath, and begin. Use 1/2 to 3/4 down elevator to do the square corners. Don't fly a long down-leg in your first few tries, do it like this:

1. Down and release (for corner number 1).
2. Pause during the down-leg (don't make it long at first, just use a slight pause).
3. Down and release again (for corner number 2). You're now flying level with the airplane inverted.
4. Do another down and release (to begin the vertical up leg).
5. Pause just long enough to climb back to your starting altitude.
6. Down and release (to level off) to complete the maneuver.

WHAT TO DO
1. Corner 1: Down, release. Use about half down here.
2. The Down Leg: Pause and dive. Watch for your horizon marker. When you pick it up. Tuck under.
3. Corner 2: This is the tuck. Down, Release. Pause. You are inverted.
–For your first attempts at 1, 2, & 3, do DOWN, PAUSE, DOWN. Lengthen the down leg as you get more experience.
–Practice this version with the short down leg several times until you are comfortable doing it. Once you can go up and do an outside square loop with ease, try lengthening the down leg to make the legs equal length. What I like to do it to pitch down and dive straight down for the ground. When I get close, I tuck under, go inverted for a while, then climb back up to the finish.
4. The Inverted Leg: Enjoy this one, the hard part's over. To keep this leg level, you may need a little down elevator. The speed will be building up so watch the line of the leg and adjust the elevator as needed. Fly as far as you went down on the first leg. Add power back in if you reduced prior to diving.
5. Corner 3: Down, release. Take it easy on this corner. You'll be going to a vertical climb and you don't want to scrub off all your airspeed with a really tight corner.
6. The Vertical Leg: Climb a comfortable amount. The maneuver's basically over once you make to inverted corner and leg. Give it a nice climb and make the last corner.
7. Corner 4: If there ever was an easy corner in a square maneuver, this is it. Make a nice, half down corner and you're done. Hey, do a snap roll to finish with a flourish.
NOTES
WHEN TO TUCK UNDER: Here's how I know when to give it down for the tuck under. I watch for the trees on the horizon. If I stay above those trees in the distance, I'll never hit the ground. Just about every field has something in the distance that is higher than ground level. When you fly by down the runway, you can see that item in your peripheral vision. You know when you are above it, you're safe.
LOOP SIZE: The size of your square loop depends on your plane's power and weight. A light, powerful plane can do a large square. Lower powered planes should do smaller squares.
CLIP OUT-TAKE TO THE FIELD *COLLECT THE WHOLE RC REPORT SERIES*
For reprints of Fun Aerobatics or back issues call R/C Report (256) 503-8436
Ed Moorman E-mail: moorman1@cox.net

Practice this "short down-leg" version as many times as it takes to make you feel comfortable while doing it. Once you can do even a sloppy Outside Square Loop with ease, then try lengthening that down leg to make all three legs equal length.

At most flying sites, here's how I know when to apply down elevator for the tuck under. I look for trees on the horizon, and as long as I stay above those trees in the distance, I'll never hit the ground. Just about every flying field has *something* in the distance that's higher than ground level. When you fly by yourself and see your airplane higher than that "tall item" in your peripheral vision, then you know you're safe.

Take your plane up and put it into a medium dive, say about 45°, and see if you can pick up something on the horizon as you get lower. You do this all the time anyway, so get used to doing it now with the down leg of your outside loop. It just takes a little practice.

RECAP

Corner 1: Down, release (use about half down here).

The Down Leg: Pause during the dive (Watch for your horizon marker, and when you see it, begin corner 2).

Corner 2: Down, release (this is the tuck under and fly level inverted).

The Inverted Leg: Pause during the inverted level leg (enjoy this one, just be prepared to use a little down elevator to keep the nose up and level).

Corner 3: Down, release (take it easy on this corner because you'll be entering a vertical climb and you don't want to scrub off too much airspeed).

The Vertical Leg (pause to climb a comfortable amount. The maneuver is basically completed once you make the next corner, so give it a nice climb and get ready.

Corner 4: Down, release (if there ever was an easy corner in a square maneuver, this is it! Make a nice, down corner and you're done).

Photo 1: Drue Kennon's Big Stick 40. Drue was a friend of mine and R/C flier back in the 1980's when he was on active duty in the Air Force and stationed here at Eglin AFB. When his tour was up, he returned home to Texas. When he started flying again he got in contact with me. I told him how I liked my Sticks, so he modified his Big Stick the same way. First he converted the flat wing to anhedral so it would fly knife edge better and do point rolls without roll coupling from the rudder. He also made it a tail dragger and used my favorite Stick gear, the DuBro Heavy Duty fiberglass and nylon gear. They don't seem to bounce as much and they don't take a set on a hard landing lake aluminum and music wire gear. Drue uses O.S. FS-70 Surpass, making his a very nice airplane.

Hey, why not do a spiffy snap roll to finish with a flourish!

Note: Depending on your model, you *may* want to reduce power just before you do that first, pitch down corner. I hardly ever do this because I'm not flying a pattern plane doing big maneuvers. When flying a fun fly plane or a Stick, it's "down and release, pause", "down and release, pause", "down and release, pause", "down and release", and I'm done. Reducing power before the down-leg and having to add it back in while inverted on the bottom leg is just a distraction to me.

As a final note, if you have a Stick or a fun fly plane, you really should practice and learn this maneuver. Pilots who don't read *"R/C REPORT"* probably won't even try it, so this is your chance to show 'em up. Give it a try.

FEATURE OF THE MONTH

The question about how to measure a model's CG (Center of Gravity) keeps coming up, so let's look at this again. We should already know about the CG being three-dimensional (longitudinal, lateral, and vertical), but let's briefly cover it anyway.

Longitudinal CG: The longitudinal CG is measured front to rear on the airplane. This is the one R/C'ers normally think of as "The CG", and the one we're talking about when we say a plane is nose heavy or tail heavy. (I'll go into more detail on those later.) Some people measure the longitudinal CG very precisely with a CG machine. Others lift the plane on their fingertips to see if it balances level. If this point is near the main spar on a Stick or a typical trainer, it's good to go. This method also works for me with straight-wing sport and 3D planes. For swept wing planes and odd balls like canards, I calculate the CG location and make a fairly precise measurement. I have a computer program I wrote many years ago in BASIC and have revised and rewritten it in several languages. Right now, I have it in an Excel spreadsheet and also in Java Script for those who don't

have a spreadsheet program. Drop me an e-mail if you want a copy.

Lateral CG: This point is the side-to-side CG. If someone says their right or left wing is heavy, this is the CG they're talking about. If you're looking for really precise maneuvers, you need the lateral CG right on the center line of the plane. For planes with the engine mounted with 0° side thrust, you can pick the plane up by the top of the tail and the spinner or prop nut and see which wing tends to drop. One common factor that can throw off your lateral CG is a side mounted engine. The engine's cylinder and muffler are then both on one side of the center line, causing that side of the plane to be heavier. Another possibility is a heavier wing panel. With so many modelers flying ARF's today, we rarely make an effort to have both wings weigh the same. When ARF's are built, the factory may have someone building right wings and someone else building left wings, while a third someone grabs one of each and packs them in the box. If you get a light panel and a heavy panel, you'll have a plane with the lateral CG off. To correct this, you can add weight to the lighter wing tip. Stick-on lead weights work, but I usually drive a couple of suitable-size nails into the wing tip. It's easy, it works, it doesn't cause any drag, and it's almost invisible. Check and adjust the model's Lateral CG after all construction and assembly is finished. This way you can com-pensate for everything at one time, such as the engine, muffler, radio gear, battery, etc.

Photo 2: Here's another Big Stick, this time a .60 size belonging to Ken Stewart, of Colorado. Ken uses an SK 90, a great engine for a .60 size Stick when you live a mile high!

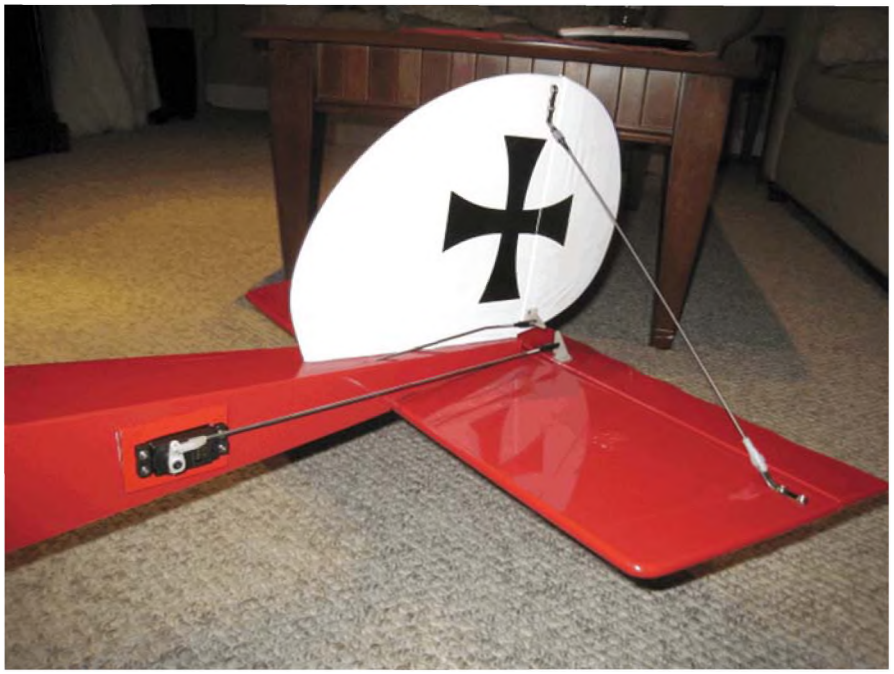


Photo 3: The tail of Ken Stewart's Big Stick 60, showing the bracing rods and the rear mounted elevator servo for balance instead of lead.

Vertical CG: The vertical CG is where the CG is located from top to bottom on the plane. As you might expect, high wing planes *generally* have a higher vertical CG than low wing planes, due to the weight of the wing itself. (Exceptions include high-wing planes with deep fuselages where the radio gear and landing gear may be installed very low.)

Now you may be thinking, "Big deal. What does this mean

to me?" Well, hang with me here as we get to the nitty gritty of the matter. For aerobatics we generally want the vertical CG near or right on the thrust line. We want this because the vertical (and lateral) CG has a strong effect on how the plane moves. Let's look at a high-wing trainer with a high vertical CG and a low thrust line. With its high center of drag (mostly the wing), the low thrust line prac-tically guarantees to pitch the model up when you add power. A low wing plane with dihedral and a symmetrical airfoil usually has a low thrust line, too. The dihedral raises the vertical CG *and* the center of drag. These two factors, and a symmetrical airfoil, tend to make a low wing plane pull straight forward when power is added, rather than pitch up. The anhedral I put in my Sticks does more than counter the rudder-roll coupling, it also lowers the vertical CG and center of drag.

Photo 4: Don Martin and his BH Models T-28. Don uses a Saito FA-100 for power, so this plane really moves! I reviewed this kit some time back, and it's a pretty good sport scale aerobatic model. It does a great blender! Flaps and I still fly ours, especially at the local warbird meet. Flaps, by the way, instructed in the T-28 many, many moons ago.

Photo 5: Here's another of Don Martin's planes. This one is a Balsa USA Enforcer, powered by a Tower .75 engine. I've flown several Enforcers, and they generally take several flights to trim out, as Don has learned. When he sent the photos, he mentioned that since the plane doesn't have rudders, he doesn't like flying it in a cross wind. I know the feeling, Don. I've flown deltas and canards that didn't have rudders, and I didn't like it either.

Nose Heavy vs Tail Heavy

What these terms mean is that when the longitudinal balance of the airplane is *checked* at the desired CG location, the nose (or tail) drops because it's too heavy. Let's say your instructions manual or plans says the desired CG range extends from 3.5 to 4" back from the leading edge at the root (next to the fuselage). Stick some masking tape on your wing so you can mark this location on both sides of the fuselage. Now lift or support the plane at this point. If the nose hangs low, the plane is nose heavy. If the tail hangs low, the plane is tail heavy. Always check your CG at the desired CG location. Then make the necessary changes to make the plane sit

Photo 6: Simulating checking the CG of a high-wing model

Photo 7: See text.

level. When it does, it's good.

Balancing upside down vs. right side up: There are numerous folk tales about balancing right side up or upside down, but there is no difference in finding the longitudinal CG except for the convenience of having more of the plane's weight below the point where you're picking it up to balance it. Look at **Photo 6**, a simulation of a high wing plane being checked. The model's vertical CG is below the points where we pick it up, so the plane hangs stable, allowing us to easily find the CG. The O.S. engine box represents the fuselage, while the carbon fiber tube represents wing's main spar. Since this is a high wing plane, its vertical CG is below the wing (the lifting point), so the plane hangs nice and steady like a pendulum.

In **Photo 7** we see our box-and-tube airplane again. This time it's either a high wing plane upside down, or a low wing plane right side up (come on, use your imagination!). We can hold the plane level as shown here, but if we release it, as seen in **Photo 8**, the plane tips over easily.

Photo 8

Does anyone out there think you should balance a high wing plane upside down? I think not. As soon as you pick it up or put it on your CG machine upside down, it will want to flip over. So why do so many people try to balance a low wing plane right side up? Unless it has a very low vertical CG and a lot of dihedral, it too will try to flip over. Turn it upside down like that in **Photo 6** and it'll be nice and stable, allowing you to find the CG more easily.

Again, a few low wing designs with a very low vertical CG and a lot of dihedral may be easier to balance right side up, but these are few and far between.

-Ed Moorman
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Shalimar, FL 32579
moorman1@cox.net

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Sparky's Revolt

By Tony Coberly

Well everyone Sparky is going to make it short and sweet this month. I have been attending a few of the local giant scale events over last weeks and I would like to thank the hosting clubs. I attended the Upper Cumberland Radio Control Society of Cookeville, Tennessee.

This club is only about 100 miles from Huntsville, so it was a nice drive up on Friday night. The UCRCS field is a very nice, well groomed grass field about 600 feet long. I brought my Extreme Flight Yak 54E with me so I could play a little myself. The weather Saturday was beautiful and the club members put on a very nice event. I and one other person had electric giant scale planes, but the rest were of the gas variety. There was always room to fly and with the temperature at about 75 degrees and very low humidity, the weather could not be better! This was my first time to the UCRCS field and I will defiantly be returning for future events. Visit there website for more information and pictures! WWW.UCRCS.COM.

Tony Coberly
Tonyc@rcreport.net

The Coffee Airfoilers AMA #592 present the 6th Annual

Tennessee Electric Fun-Fly

October 10-11th 2009

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- Open flying both days -- No contests -- Just fun
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- ***For maps and lodging info: http://www.coffeeairfoilers.com***

Details

- Start Time 7:30 both days
- Current AMA Card Required to Fly
- Landing Fee: $5.00 each day
- Spectators Welcome—lunch and snacks available
- Event CD: Phil Hyslip zippy@coffeeairfoilers.com

BALSA USA

Build Your Dream Into a Reality!

1/4 SCALE NIEUPORT 17

reader's report
by jesse wall

READERS' REPORT

Balsa USA's 1/4 scale Nieuport 17

Model . . . . . 1/4 Scale Nieuport 17
Type . . . . . Biplane
Manufacturer . . . . . Balsa USA
P.O. Box 164
Marinette, WI 54143
(906)863-6421
Distributor . . . . . Direct
Suggested Retail Price $259.95
Wing Span . . . . . Advertised: Top: 80"
Bot: not specified
Measured: Top - 80-1/8", Bot - 74"
Wing Area . . . . . Advertised: 1575 sq. in.
Measured: 1623 sq. in.
Airfoil . . . . . Flat bottom
Fuselage Length . . . Advertised: not specified
Measured: 61"
Recommended Controls 4
(Ail, El, Rud, Throt)
Recommended Engine . . . . . 1.20 4C or G23
Recommended Fuel Tank . . . . . 16 oz.
Recommended Model Weight . 12 to 14 lbs.
Basic Materials . . . . . Balsa and plywood
Instructions . 52 (8.5x11") pages b&w photos
Plans . . . . . Two 35x56" sheets and
two 24x57" sheets
Hardware Included . . ABS cowl (aluminum option available), 3/16" pre-bent main gear wire, 5/32" pre-bent main brace wire, plastic landing gear straps and wood screws, two straight 5/32" wires for interplane struts, two pre-bent 5/32" wires for interplane struts, two pre-bent 5/32" wires and tabs for aft cabane struts, two 1/4-20 nylon bolts, 1/8" pre-bent tail skid wire, two aluminum "D" tubes for stabilizer braces w/screws, 3/16" tube for rudder pivot, pre-bent 5/32" wire for

rudder, 5/32" wheel collar for rudder, six metal tabs for interplane struts, nylon hinges, 2-56 blind nuts for interplane struts, 8-32 blind nuts for cabanes, two sheets of aluminum for inspection covers w/screws, plastic strap and screws for mounting tail skid, 2-56 pushrods for ailerons and clevises, plastic control horns (for all surfaces) w/screws, and clear plastic for windshield.

Items Needed To Complete . . . Copper wire, vintage wheels, fuel tank, 4-ch radio with five servos, pushrod materials, pull-pull cable assembly, 3/16" wheel collars, fuel line, covering materials, engine, and engine mount.

COMPLETED MODEL

Finished Weight . . . . . 15.5 lbs. (248 oz.)
Wing Loading . . . . . 22.0 oz./sq.ft.
Engine Used . . . . . BCMA-SPE 26 gas w/electronic ign
Propeller Used . . . . . XOAR 16x8 wood
Propshaft to Ground . . . . 14.5" (held level)
Fuel Tank/Battery Used . . DuBro 16 oz. gas
Radio Used . . . . . Futaba 9CAP transmitter, Futaba R147DF receiver, two Hitec HS-645MG servos (for rudder and elevator), two Futaba S3010 servos (for ailerons), and one Futaba S3004 servo (for throttle).
Covering/Finishing Used . . . . Silver Solartex all except Coverite on rudder
Special Items . . . . . R/C Cats Electronic Kill Switch, and Balsa USA's Vickers machine gun kit, Lewis machine gun kit, pilot figure, and decal set.

Cheers - Excellent quality wood; very good die-cut parts; well illustrated good instructions manual (but see Jeers.); excellent customer support; a beautiful flyer!

Jeers - No parts listing; some parts missing; instructions manual needs updating; instructions not available for internet downloads; small fingers needed for mounting upper wing; completed model is over 10% heavier than advertised.

I'm sure many of you have seen the movie *"Fly Boys."* Being familiar with the history behind the Lafayette Escadrille, I decided to purchase the movie. I was a little disappointed to find that the movie was only loosely based on the Escadrille, but it's still a good movie. My wife Karen, however, enjoyed the movie so much she asked me (while watching the movie) *"Does anyone make a model airplane like those?"* I replied, *"If anyone does it would be Balsa USA."* And upon checking Balsa USA's website, I learned that they did indeed have Nieuport kits. I opted for the 1/4-scale kit because the 1/3-scale is just too big for me to carry to the field. Since my daughter, Kathryn, also flies, when we go to the field we take two planes with us.

Our vacation was already set for visiting family and friends in Ohio, during which a side trip to the Toledo R/C Show was scheduled. I explained to my wife that I had already chosen the Balsa USA Fokker DR.1 as my next kit, but she insisted that I purchase the Nieuport too! I have to admit that this is the only time she has ever insisted that I buy an airplane, and you just don't pass up an opportunity like that! So at the Toledo show our first stop was the Balsa USA booth!

While at their booth I also purchased the decal set, the Lewis and the Vickers machine gun kits, and the DuBro 7" vintage wheels. The instructions suggest using 6-5/8" wheels from Williams Brothers, but Balsa USA carries the 7" wheels, so that's what I bought. What can I say, I like one-stop shopping. When we returned home Karen took it upon herself to make sure the Balsa USA Nieuport 17 kit was placed on *top* of my building stack. The Fokker would have to wait.

Before beginning construction there were a few decisions I hade to make. The first was the elevator, which can be built joined or in two halves. If I chose the one-piece elevator, I'd need a high torque servo. That's the way I went, but now I recommend going with the split elevator. Although I had no problems with the

single elevator, I believe you'll get a better response from two, and I'll probably convert mine some day. Another option is if we want to use the aileron bell cranks. These are non-functional on the model, but they are a prominent feature of the Nieuport 17, so I installed them. Next is the weaponry. There's the Lewis machine gun that's mounted on the top wing, and the Vickers gun mounted on the fuselage. Here we can choose one or the other, or both if we wish. I used both sets, but if you go with the Balsa USA guns, keep in mind that they are a building project themselves. Now that Williams Brothers is back in business, you can get the Vickers from them. The latter are easier to build and they include an ammo belt. Unfortunately, they don't carry the Lewis gun.

The next step was to inventory and sort the wood pieces by size and type. I find that this saves a lot of time later during construction, preventing a lot of repeated measuring. The Balsa USA kit did *not* include a parts list which would have told me early on that my kit was missing a few pieces. Fortunately, it was nothing that I didn't already have or couldn't get at my local hobby shop. While inventorying the parts, I also like to label the die-cut sheets. I noticed four parts on the sheets that stated they were for the elevator, but they were actually for the fuselage.

A few notes were in the kit. One concerned a piece of wood for the aft top wing struts. A bag with the correct part was accompanied by a note regarding the slots that were not cut in the original part. Another note was for the updated false ribs for the upper wing. I removed the incorrect pieces and put them in my scrap pile. Finally, there was a note that the top crutch for the fuselage was not cut correctly. It said to *"follow the template below"*, but the rest of the sheet was blank! A call to Balsa USA's Dave explained that I needed to use the plans and cut notches in the crutch for the forward cabanes. He also stated that this correction should have already been made in their production runs, so I apparently got an older kit.

During the call I asked about choosing an engine. Dave recommended the Zenoah G23, but I said I was considering a 35 or 40. He advised against that, saying that they tested a G26 on the plane and had to go with a bigger prop to slow it down! So, I chose the BCMA-SPE26. I'd previously used one in my Spacewalker II, and I'm very happy with it. As noted in the instructions (in at least two places) this is not a Pitts-style bipe, and it's not designed for heavy aerobatics or 3D flying.

I'll be using Balsa USA's adhesives to assemble the Nieuport 17. With these adhesives and any other modeling chemicals you may use, please provide proper ventilation during their use.

One word of caution before beginning to assemble the kit. Read the instructions manual thoroughly before starting, and make notes of any steps that may need clarifying. The instructions are quite good with a lot of clear photos and useful tips scattered throughout, but some steps have so much information in them, it's easy to miss something. The first thing I did was to make a copy of the manual so I could add notes in one. I hate writing in my original manuals, so I use the copy during construction. This is why I wish Balsa USA provided downloadable PDF filles of their manuals. It would also give the prospective builder a chance to see what the build is going to be like before making the purchase.

Construction begins with the wings, each constructed in two pieces. I built an upper wing half and a lower wing half first because I have a large building table and the plans have an upper and lower section per sheet. The instructions are straightforward except for one issue on the lower wing. Each half of the lower wing has plywood dihedral braces, the short side of which is installed against the wing rib, and the long side going into the center section. I installed mine by placing the braces flat on the building board, but later (when setting the dihedral) I found that the braces needed to be realigned. I suggest just tacking the braces in place until you

actually set the dihedral. I had to break the braces loose and readjust them for the best fit. Another tip is to take sheets of paper and make tubes for the top wing to route the servo cables.

I was extremely impressed with how light the wings built.

Joining the wing panels requires a long surface since the Nieuport has swept wings. If you don't have a long steel ruler, the instructions explain how to use string to set the sweep. The sweep must be set and the center parts sanded to fit. The upper wing is set first and the lower wing is butted against the top to set it up. The top wing is flat, while the bottom has dihedral, using 1-1/2" blocks at the tip rib to set the amount. I recommend double-checking the center section's fit to make sure the sweep hasn't been disturbed, before gluing anything.

Before sheeting the center section of the top wing, give some consideration as to how you plan to route the aileron servo cables. I decided to mount charge receptacles on the bottom of the wing and plug in the cords from the fuselage. I installed the receptacles with 36" heavy duty servo extensions which completed about 90% of the wings. If you choose to use this method to connect the ailerons, leave enough slack cable to avoid stressing the wires and connectors while connecting and disconnecting them.

Next is the fuselage construction, and this begins by laminating 1/8" die-cut parts to make 1/4" thick parts. Again, the instructions are straightforward here. When beginning to pin down the parts for the sides, a long straight edge is needed to ensure that the upper longerons are perfectly straight. During assembly I found that the F1-A formers were not quite symmetrical. I lined them all up to ensure the slots were aligned and then marked the fronts, so they were all installed the same direction.

When assembling the fuselage sides, I found that mine were 1/4" short of the top view plans, but were correct with the side view plans. I simply added a 1/4x1/2" piece of balsa at the tail, and shaped it to fit. This turned out to be right on, as the tail feathers then fit perfectly.

The front half of the fuselage is sheeted with 1/32" plywood. I recommend test fitting the pieces before gluing, due to their complex curves. I glued my side pieces to the upper longeron and let the glue set before forming it. The right side is sheeted with one large sheet, while the left side uses two smaller sheets. This is due to the non-symmetrical nature of the sides. When fitting the aft sheet on the left, I found that it was just barely the size needed, so use extra caution for a proper fit.

The tail feathers come next. Here too, 1/8" die-cut pieces are laminated to make 1/4" thick pieces. To assure proper alignment of the two pieces, the elevator and stabilizer are built as one-piece and then cut apart. I found no surprises during construction here, just follow the instructions for the configuration you choose.

Then it's time for some real assembly. Before mounting the bottom wing save yourself a little work and mount the forward struts in the fuselage. The wooden wing dowels are set in the wing. The leading edge is notched and the dowels are tacked in place after the wing alignment is checked. Then the dowels are reenforced with 1/4" square scrap balsa on the top and bottom. I also opted to add some more stock to the sides, totally enclosing the dowels.

With the bottom wing mounted, the aft cabane struts are assembled, soldered, and installed. Then the top wing is placed on the struts. This is my first biplane, so I had a really good time with the next few steps. The object is to get the spacing between the top and bottom wings the same on both sides, and to set the proper top wing incidence. I spent a considerable amount of time measuring, adjusting, and measuring again. The instructions explain how to set the incidence by setting the firewall on the table and measuring the distance of the leading edge to the trailing edge, but I chose to use my incidence meter. Also, be careful when measuring that you don't push a wing out of position. When the wing is set, clamp it into position so that the blind nut holes for the forward cabanes can be drilled.

Now on to the interplane struts. When measuring for the mounting holes, do *not* use the plans! Measure from the center of the wings and make sure to use the same measurement on each wing. You may have to make slight adjustments to the distance to prevent drilling holes into ribs, but just keep them the same. Also, when installing the strut wires, make sure that they don't push the wings out of position.

Now we can wrap the struts in copper wire at the lower junction point. There was no copper wire supplied with my kit so I used some I had on hand. Once everything is set, double check the wing measurements again and then solder the struts and mounting tabs together.

Now we install the tail feathers and landing gear. After getting the two landing gear wires set, wrap the junctions with copper wire, and solder them securely. I wrapped mine in wire, got them all set, and then transferred the gear to a scrap board so a friend could *weld* them for me. There's an option for a wheel spreader bar, and I highly recommend using it. I didn't, and I now have a lot of spreading on the gear once the plane is assembled and placed on the ground. The real Nieuport had a solid bar between the wheels. This helps prevent the spread, but it also reduces cushioning on landing.

The engine mounting instructions show a Zenoah G-23 bolted directly to the firewall. I decided to mount my BCMA 26 on a Great Planes isolation mount. I also had room to mount the electronic ignition module and switch on the firewall, which helps keep the ignition system far away from the radio gear. Then I mounted the ignition battery to the underside of the tray that I made for the fuel tank. My throttle servo was mounted back in the fuselage, but the instructions show it mounted on the firewall for the G-23. If you're using an electronic ignition, avoid this! Use a Ny-rod for the throttle, and *not* an all-metal pushrod, or you'll be begging for radio interference.

The real Nieuport has a rather shallow cowl, and the cowl in the kit is designed so you can cut it down as needed. Due to the isolation mount, my engine stuck out far enough that I was able to use the cowl "as is".

The instructions show a suggested layout for the fuselage servos. I mounted the rudder and elevator servos as suggested, but I mounted the throttle servo closer to the bottom of the fuselage so I'd have a straight shot to the throttle arm. The shown mounting method for the aileron servos is the very basic, servos exposed setup, so that's what I did. But now I wish I'd gone ahead and mounted the servos inside the wings. It would have looked so much better. The aileron servos are connected to separate channels to allow for an easy aileron differential setup. This is the suggested way, and after flying the Nieuport, I agree. I drilled holes in the fuselage in front of the aft wing struts just large enough to pass a servo extension cable through. The cables were routed up the aft struts, and Solartex was wrapped around the wires and struts to hide them. The cable loops at the top, and the bottom of the struts were painted silver.

I mounted the radio switch in the cockpit, right in front of the pilot figure. The receiver and battery were mounted under the pilot. While it would have been better to mount things more forward, I decided to err on the side of caution, isolating the receiver from the ignition.

I found an error in the instructions when it came time to mount the cowl. The instructions tell the builder to use five cowl mounting blocks, but the plans show seven, so I used seven. The instructions also state that if the Vickers machine guns are used, we should offset the top block, but there's no need to do so. The instructions show it mounted in the center, but on the real Nieuport the Vickers gun is offset to the pilot's right side.

Now we come to the interplane strut fairings and wheel fairings. The interplane fairing is shaped and glued to the struts. Be very careful not to let the CA run, because the fairings are later stained, and any glue runs will show. I used a dark walnut stain. The struts and fairings are then wrapped with heavy thread. My wife found a hemp cord in a crafts department which work-

ed nicely. After that, seal the struts and thread with clear polyurethane. I covered the landing with silver Solartex.

Now it's time for the covering. The whole plane was covered with Solartex except for the rudder. There I used some Coverite I already had, and painted it with Krylon spray paint.

Now it's down to the final details, with mounting the guns and finishing the wings. I chose to make the Lewis gun removable in case of a nose over. And while I did install the bell cranks, I did not add the linkages going down to the fuselage, as these would probably wind up broken in transport.

One last detail is the windshield. The instructions say to use cardboard, but I used 1/16" plywood and applied a dark stain. In photos of a real Nieuport, the wooden windshield frame is shown strapped to the aft wing struts. So I drilled four small holes in the windshield frame, and after mounting the wings I used black wire ties to fasten the windshield in place.

Another thing to watch out for if you buy the Balsa USA decal set is that the large roundels do not have transfer tape. The roundels are in two parts, the outer red ring and the white ring with blue circle. I used masking tape to keep them together until they were placed on the upper wing. Also, before putting the roundels on the upper wing, clamp the ailerons flat and remove all linkage hardware and servos. Put some soapy water on the area where the decal is to be applied, which allows you to move the decal around to get it set. Once the wing decals are complete let them set overnight before cutting the aileron joints.

The kit comes with two pieces of aluminum plate to make the inspection covers. I cut these out and placed them as required. My kit did not contain any coaming for the cockpit, so I simply split some black rubber tubing and ran it around the cockpit.

After completion it was time to check the CG. Balsa USA's website said it was 4" back from the center of the top wing. This was going to require a lot of weight, so I decided to recheck the plans, which showed 4-1/2". I wanted to take no chances with this, so I called Balsa USA and they confirmed that the plans are correct (and then they immediately changed the figure at their website!). To achieve the correct CG I still had to add 2-1/2 lbs. of weight to the nose, but note that the recommended engine is 18 oz. heavier than the engine I used.

The Nieuport 17 has a very short nose, because in WWI the large radial engines were so heavy they had to keep the nose short for proper balancing. I'm not a fan of adding dead weight, but the CG has to be right.

I contacted my good friend, Roger Marshall, to meet me at the field for the Nieuport's maiden flight. Roger and I share a love of scale, vintage aircraft, and he's been my mentor ever since I returned to the hobby. He's also the guy who keeps telling me, *"Bigger is better."*

We picked a perfect day, with little wind, one of the few we've had so far this year! After assembling the plane, which took about 10 minutes, my wife set to work taking lots of ground photos. Trying to get the upper wing bolts in the aft struts is a real pain, especially if you have large hands like mine. I have no idea how I would have done it if the connecting rods to the control horns had been installed. With that out of the way, the next thing was to muster the courage to get it airborne. Karen switched over to her video camera, and with the help of club members Roger and Greg Flex, we got the Nieuport started and completed a thorough radio range check.

The Nieuport is also my first experience with a tail skid, and boy let me tell you it's fun! I tried to taxi out but could not get the plane to turn in the wind, so Greg picked it up and carried it to the grass runway. With the elevator neutralized, I began applying the throttle. I found the rudder to be very sensitive so I swerved down the runway. I wound up throttling down, and bringing the plane back, which gave me some more practice steering the plane. I got the hang of it, finally... or so I thought! With a skid you turn the

rudder, apply a little down elevator, and give it a blast of throttle. It took a big blast, but I managed to get the plane turned. The tighter the turn, the more down elevator is required, but be careful not to nose her over.

On my second attempt I went straight down the runway, again with the elevator neutralized. The tail came up almost immediately, and after a long roll out, she lifted into the sky in a perfect takeoff. The nose kept coming up, so I began to add down elevator to prevent bleeding off all my airspeed. It took a few clicks of down elevator and right aileron to get the plane straight and level. I think maybe another degree of down thrust is needed.

The flight was "as advertised...", slow and smooth, and the plane handled beautifully as I made numerous laps around the field. At our field, the pilots are kind enough to let those making maiden flights have the sky to themselves. The plane looks beautiful in the air, just like the real thing. The rudder is very effective, so watch it there. Applying about 1/4 rudder, the plane made a sharp turn and quick dive. Fortunately, I was keeping the plane rather high during its first flight.

After about ten minutes it was time to land. I brought the plane around and reduced the throttle to about 1/4 after making the final turn, and began slowly dropping it as I got closer to the ground. I chopped the throttle to idle just before the touchdown, but I was still coming in a little hot. She set down perfectly on the mains, made a couple of bounces, and rolled straight down the runway. It settled right down and I slowly fed in up elevator as the speed bled off, and the tail set down on the ground. What a flight! The spectators cheered, many offered positive comments, and I... well, I started breathing again. The post flight check revealed nothing loose or missing.

Dave, at Balsa USA, was right. The 26cc engine is *plenty* for this plane. I know from my previous BCMA 26 that after about a gallon of fuel, the power increase will be significant. The extra nose weight was not a problem, but I still wish it wasn't there. The plane is not fast, and it flies very scale-like. Although I can see where someone might want to add a larger engine for more power and more nose weight (I was tempted, myself), I prefer the beauty of scale flying.

My second flight attempt proved unsuccessful due to a problem with the tail skid. While maneuvering out, the end of the skid popped out of the fuselage and bent over, so we went back to the shop for repairs. The skid is mounted with one strap fastened at the bend point. I added a second landing gear strap at the point where the skid enters the fuselage to prevent it from coming out again.

Afterwards I had a few problems with the engine not running right. But after working that out and getting in a few more flights, I soon felt very comfortable with the new model. I still have a lot to learn when it comes to ground handling, but flying and landings are quite good. On my first flight after getting the engine running right, I handed the transmitter to Roger, mostly because I hate seeing a grown man drool. He made a couple of passes and then offered several very positive comments on how the model looked and flew. I could tell he was enjoying it a lot.

After taking back the transmitter, I made a few more passes before my timer said it was time to come down. On my final approach, I began chopping the throttle to settle her in. The glide path was perfect, and about 6' off the ground, when Roger said, *"Cut your throttle a little."*, but I was already at idle. Feeding in a little elevator to keep the nose level, she set down for a perfect two-point landing with no bounce, and rolled down to a stop right in front of the flight station. Boy was I glad my wife got all that on tape!

The Bottom Line: Would I recommend this kit to others? *Yes!* If you love vintage aircraft, this is an excellent airplane. I enjoyed building it, and the end result is just wonderful. It's a slow and stable flier that's wonderful to watch and a real joy to fly. It does not handle well on windy days, of course, so if you fly in a crosswind, be ready

to correct a lot with the ailerons. This kit is not a beginner's kit, either, but someone with intermediate building skills should have few problems. Just take your time and follow the manual.

Ground handling is a challenge if you're not used to this type of plane, but I like a challenge and learning new things. Here's where adding some exponential to the rudder really helps. Definitely take the time to practice some ground handling.

Hard-line reviews often focus on the negatives of a model to make sure the reader is forewarned. I mentioned my issues in hopes of helping any readers building this kit. Overall, I think it's a very good build, and there's a lot more right about this kit than wrong. The overall quality is typical Balsa USA... *excellent*! Most of the build went without surprises. You can add as many or as few details as you want, but build it right and you'll be rewarded with a plane you'll love to fly and own. This model will certainly turn a lot of heads at any flying field.

I highly recommend the use of colored covering material instead of paint. Even so, my plane came out heavier than advertised. I had originally planned to use paint, but since most of it was silver anyway, I opted to use Solartex to save both time and weight. This was my first use of Solartex, but it sure won't be my last. If you want a fabric finish, Solartex is the way to go!

I can't say enough about the support from Balsa USA, either. I really like that you can call and not get the infamous "Press one for...", etc. You talk to a real live person when you call, and they always took the time to answer my questions. Would I buy another Balsa USA kit? You bet! This plane is a keeper, and I already have their 1/4 scale Sopwith Pup on the stack. Did I mention that I also want a DR1? Guess where I'm going to buy it.

How did my wife like it? She's ecstatic! She was cheering during the flights and landings, and she rarely lets me fly anything else now!

I would like to thank my good friend Roger Marshall for his assistance and advice throughout this project, and my wife for suggesting this model, taking the photos and video, and for always supporting me in this hobby. My thanks to my friend Greg Flerx for his assistance, too.

Well, gotta go now. Roger's getting out his DR1, so we're off on the next Dawn Patrol!

- Jesse Wall
Cassatt, SC

Aircraft Modelers Research

Giant Stick 50

PRODUCT TEST REPORT

by dick pettit

PART II: BUILDING THE KIT

(Note: Part I, the basic review and flight testing, appeared last month.)

Model Reviewed . . . . . Giant Stick 50
Type . . . . . Giant Sport Model
Manufacturer . . . Aircraft Modelers Research
1175 Frechette
Longueuil, Quebec
Canada J4J 1G9
www.amr-rc.com
(450) 677-4694
Distributor . . . . . Direct from mfg.
Suggested Price $365.00
Wing Span . . . . . Advertised: 106"
Measured: 106"

Wing Area . . . . . Advertised: 2780 sq. in.
. . . . . Measured: 2564 sq. in.
Airfoil . . . . . Symmetrical
Fuselage Length . . . . . Advertised: 80"
. . . . . Measured: 90"
Recommended Controls . . . . . Five (Ail, El, Rud, Throt, Flaps)
Recommended Engine . . . . . 50 to 80cc gas or equivalent
Recommended Weight . . . . . 20 lbs.
Basic Materials . . . . . Laser-cut plywood and balsa
Instructions . . . . . 62 illustrated pages
Plans . . . . . None supplied or needed
Hardware Included . . . . . 5" DuBro wheels, wing mounting hardware, formed aluminum main gear and mounting hardware, leaf spring tail wheel.
Items Needed To Complete . . . . . Spinner, propeller, engine, engine mount, fuel tank with plumbing, all control linkages and connectors, point-style hinges, screws for servo and main hatches, seven heavy duty metal gear servos, one standard servo, a 5-ch radio system, covering, adhesives, etc.

COMPLETED MODEL

Finished Weight . . . . . 23.5 lbs. (376 oz.)
Wing Loading . . . . . 21.17 oz./sq.ft.

Engine Used . . . . . Zenoah G-62 Lite from RC Ignitions, with a J'TEC side-mounted muffler. Total weight 75 oz.
Propeller Used . . . . . Vess 22x8 wood
Propshaft to Ground . . . . 13.5" (held level)
Fuel Tank Used . . . . . DuBro 24 oz.
Radio Used . . . . Spektrum DX7 radio system with seven JR Sport ST126MG servos, one Hitec HS-425BB servo, two 2-cell 2300 mah A123 radio batteries, one 2-cell 1100 mah A123 ignition battery with homemade voltage regulator, and three Radical R/C heavy duty charge switches.
Covering/Finishing Used Hangar 9 UltraCote
Special Items . . . . . Robart Point-style hinges, and DuBro control linkages, heavy duty servo arms, and fuel system materials, plus as Tru-Turn Cub prop hub.

Cheers - Excellent laser-cut parts; all parts clearly identified with exact fit exactly as designed; quick assembly despite the high part count and overall size; excellent flight characteristics, from slow and gentle to moderately fast and aerobatic; literally lands at a walking speed!

Jeers - Several parts missing; wing area significantly less than advertised (by 216 sq.in.!); 18% heavier than advertised (by 3.5 lbs.10; engine not included in advertised overall length; sparse completion instructions for installing the engine, radio, fuel system, control linkages, wing, etc.; elevator servo wire tube was blocked at both ends; more reinforcement needed at the landing gear mount (see text).

In Part II this month we're presenting the step-by-step building sequence, along with my notes and suggestions. The overall summary and flight tests appeared in Part I last month.

BUILDING THE AMR GIANT STICK 50

The kit includes a pair of 5" DuBro wheels, heavy duty aluminum gear legs, a bunch of nuts and bolts to hold the wings and gear in place, and a nice leaf spring type tail wheel assembly from Ohio Superstar. The rest is left to the builder to provide. Since I keep a lot of airplane hardware on hand, all I needed was the control linkage parts and a fuel system (tank, tubing, and fuel filler for gasoline), which I ordered from DuBro, along with some point-style hinges from Robart Mfg. Hangar 9 UltraCote covering material and heavy duty JR Sport servos were ordered from Horizon Hobby.

I unpacked the kit box and began removing the many laser-cut parts from their sheets, which took about an hour (see **Photo 1**). The laser cutting is simply excellent, with only the slightest finger pressure needed to pop the tiny remaining connector bridges loose. The balsa

Photo 1: Popping out the beautifully laser-cut parts (in the box) left quite a pile of scraps, as seen at right.

Photo 2: Fuselage parts stapled to building board during the lamination process

Photo 3: Landing gear mounting blind nuts

parts were even easier to break free, with several falling out by themselves.

I'll be using yellow carpenters glue wherever possible, and Pacer Brand CA's and epoxies when necessary. When using any modeling chemicals, as when sanding, grinding, and painting, be sure to provide adequate ventilation in your work area.

Another useful tool I'll be using is my trusty Master Airscrew razor plane. I've had mine for over than 15 years, and I think I'm on my third blade, but the current edge still has a lot of life left. If you plan to build many BIY kits, get your own razor plane, and you'll be glad you did. It was used a great deal in this kit, especially on the leading edges of the wings.

The manual begins by describing several parts of the fuselage structure that need laminating before being added to the fuselage assembly. The first AMR kit I built started out this same way, so I decided to jump ahead in the instructions and laminate all the parts needed in that major area. Since I'm using yellow carpenter glue for most of this, I could coat a bunch of surfaces with glue, align them, and staple them to the building board. Yes, I said I *stapled* the parts to the board, as seen in **Photo 2**. This keeps the parts flat and aligned while the glue dries, and then the staples are

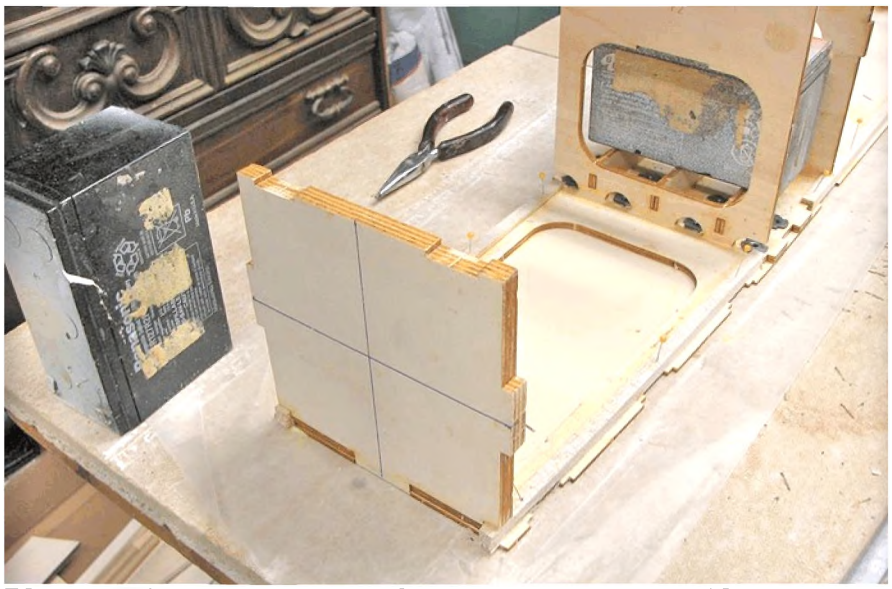

Photo 4: Firewall epoxied to fuselage bottom and held square

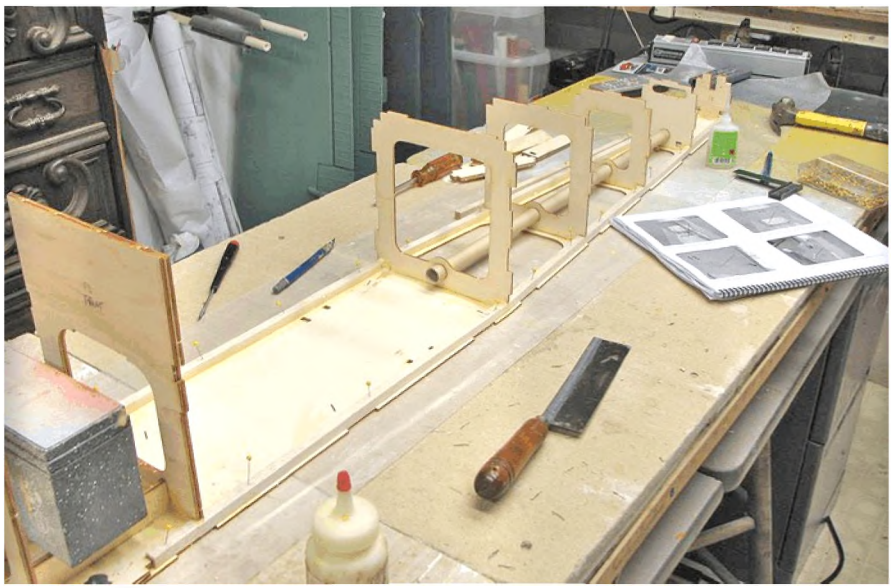

Photo 5: Remainder of fuselage formers glued into place

Photo 6: Servo lead tube installed

easily removed. Some of the larger parts that need to be joined but not laminated will need a piece of wax paper under the joint to keep the ceiling tile surface on my building board from becoming a part of the airplane.

Once the fuselage front and back bottom and side pieces were joined, and the doublers laminated into place, blind nuts for mounting the landing gear are inserted into the pre-drilled holes (see **Photo 3**). A small hammer provided the extra force needed to seat them into the wood, and a drop of thin ZAP keeps them there. The laminated firewall is then epoxied to the fuselage bottom, and squared to the surface (see **Photo 4**). The landing gear braces and the remaining fuselage formers are then epoxied into their respective locations (see **Photo 5**) and allowed to cure, making sure they stay perpendicular to the fuselage bottom. A cardboard tube for tail servo leads was glued into the formers at this time (see **Photo 6**).

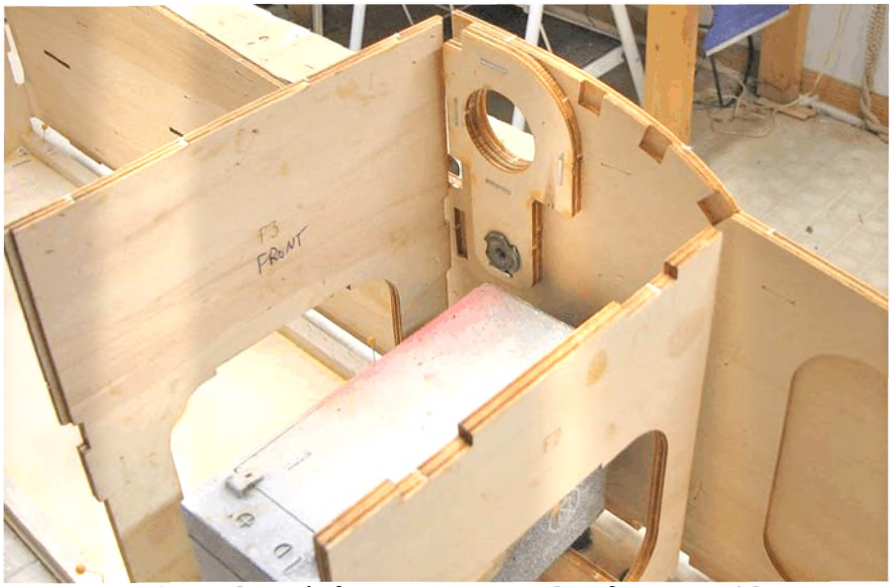

Photo 7: Wing tube reinforcements glued to fuselage sides

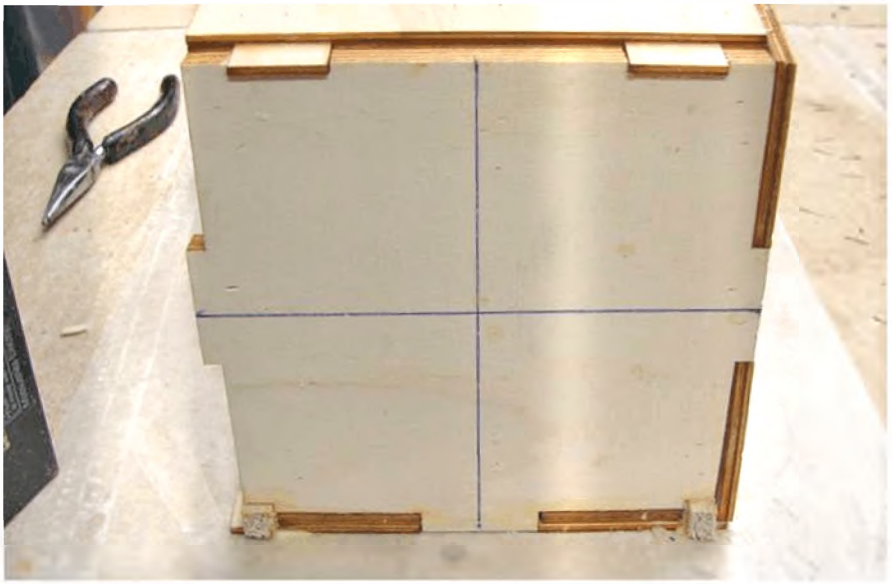

Photo 8: Firewall alignment lines for engine mounting

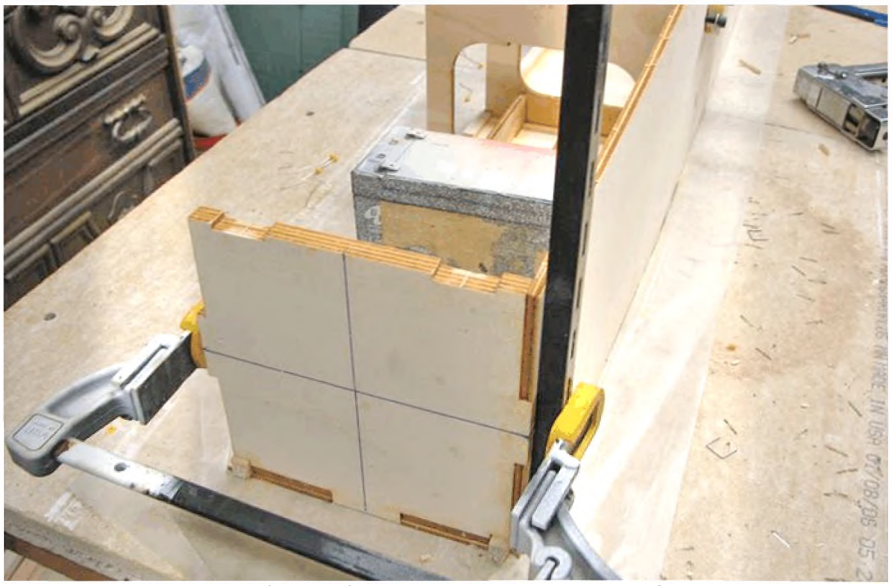

Photo 9: Fuselage side being snapped and glued into place

A set of wing tube reinforcement parts are glued to each fuselage side,. and then each side was dry fitted to the fuselage bottom and formers (see **Photo 7**). I found that only a very tiny amount of plywood required removal at one joining slot to allow the first side to be snapped into place. Yes, I said "snapped" because the fit is that precise and snug. Then the forward hatch framework was then fitted, with the actual hatch to be attached later with wood screws. I drew a set of alignment lines on the front of the firewall to aid engine installation later (see **Photo 8**). Balsa sticks were glued to the perimeter of the fuselage to aid in supporting the sides.

Permanent installation of the first fuselage side began with fitting the front to the firewall, while making sure everything from there back fit perfectly into place (**Photo 9**).

Photo 10: The rest of the side glued and clamped into position

Photo 11: Rubber bands and clamps keep everything in place

Photo 12: Close-up of rubber bands and sticks used as a clamp

Slow setting epoxy was used at the firewall joint, using a large clamp to hold it in position. From there on back I used carpenter clue and lots of clamps, clothes pins, and rubber bands to keep the side snugly against the formers (see **Photo 10**). The rubber bands were used only because I ran out of suitable clamps (see Photo 11). **Photo 12** is a close-up of how I used rubber bands and scrap balsa to hold the sides in place. I won't bore you with the installation of the other side because it went exactly like the first side.

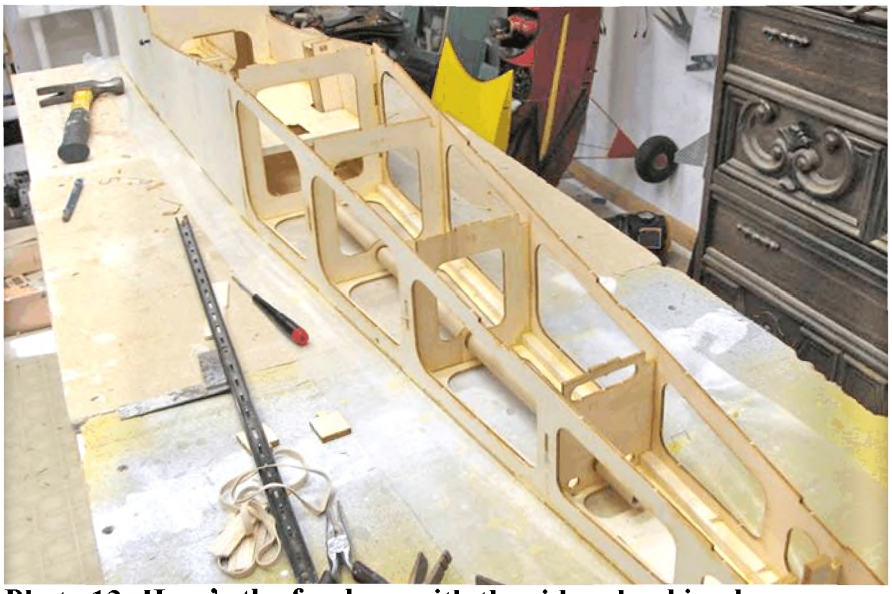

Photo 13: Here's the fuselage with the sides glued in place

Photo 14: Laser-cut balsa fin mount installed

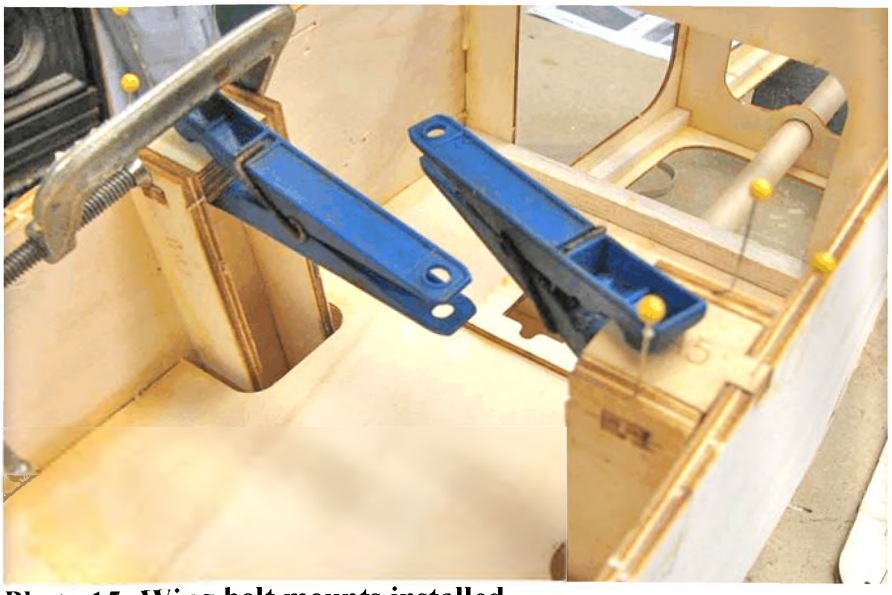

Photo 15: Wing bolt mounts installed

Photo 13 shows the fuselage after the adhesives cured and all the clamps and pins were removed. A laser-cut fin mount was then glued to the top of the fuselage at the rear (see **Photo 14**). Several parts were glued into the wing opening in the fuselage, to eventually become the wing mounts (see **Photo 15**).

Photo 16: Front hatch glued and pinned in place

Photo 17: Rear of fuselage sheeted with balsa

Photo 18: Fin and rudder framed using laser-cut balsa and sticks

I would normally have used a piece of plywood from side to side, but this worked okay. The hatch piece on the front was glued into place and sheeted with balsa (see **Photo 16**). The rear of the fuselage was also sheeted with balsa, and allowed to dry overnight (see **Photo 17**).

Moving on while all that glue was drying, I assembled the tail surfaces which are made from laser-cut perimeter pieces and balsa sticks (see **Photo 18**).

Photo 19: Stab is also laser-cut balsa

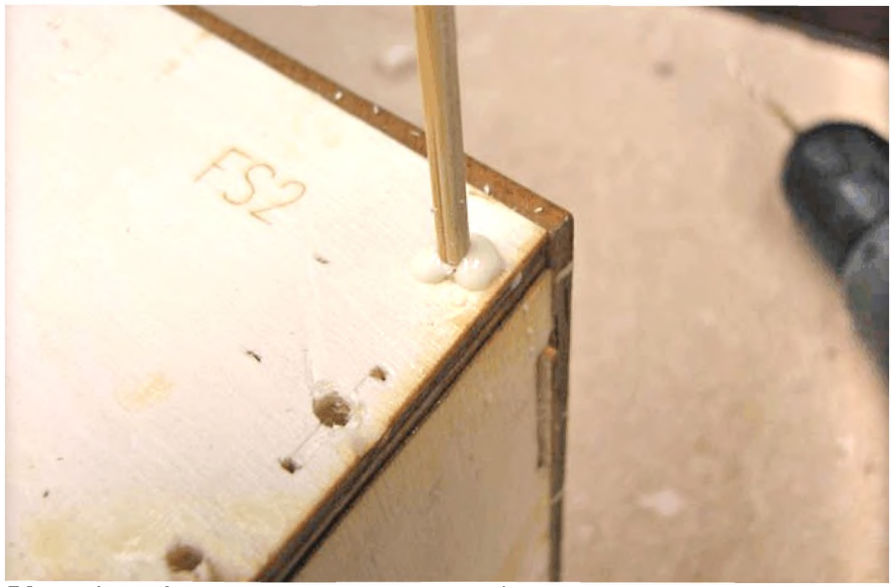

Photo 20: Firewall pegged to sides with bamboo skewers

Photo 21: The fin was inserted and checked for vertical

The stabilizer and elevator halves are also laser-cut, including the scalloped trailing edges (see **Photo 19**). While those parts were drying, I pegged the firewall with bamboo skewers and yellow glue (see **Photo 20**). This will add a great deal of strength to the firewall to fuselage side joints.

I inserted the completed fin into the slot at the rear (see **Photo 21**), and once it fit down through the slots in the bottom of the fuselage, it was perfectly vertical relative to the top of the fuselage.

Photo 22: There's that traditional "Das Ugly Stik" look!

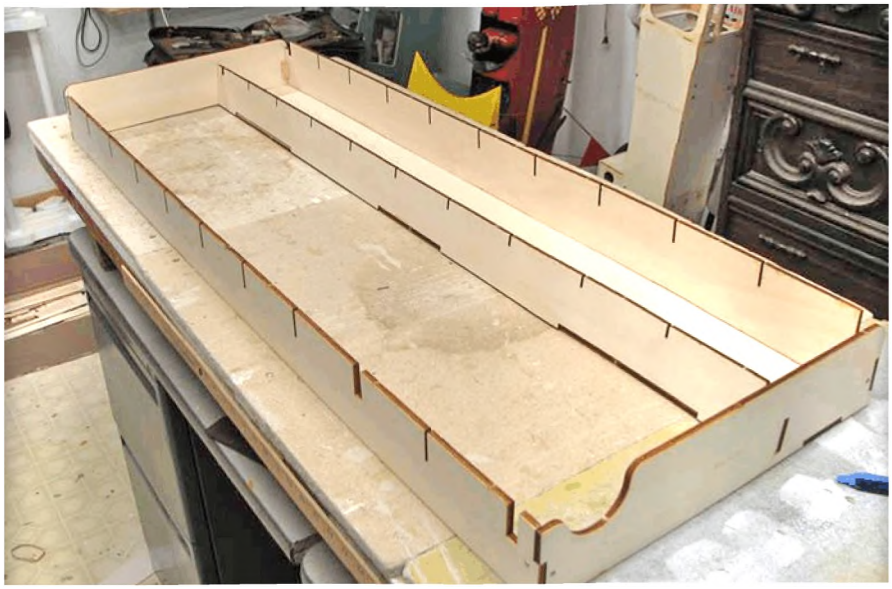

Photo 23: Wing jig assembled and ready to use

Photo 24: First ribs installed in jig, laminated ribs still drying

Just to be sure, I slipped the stab and elevators under the fuselage, added the rudder, and observed that classic 'Das Ugly Stik" look (see **Photo 22**).

It was time to start on a wing panel, but first I had to assemble the wing jig. This is made from laser-cut 1/4" plywood, and assembles easily to fit both wings (see **Photo 23**). Keep in mind that each wing panel is assembled upside down at first, so be aware of which wing you're building before you start gluing.

The laser-cut ribs are inserted into their slots and then the laminated larger ribs are added (see **Photo 24**). I guess I'll have to wait until the glue dries on those laminated parts before continuing.

Photo 25: Balsa and hardwood spars glued into place

Photo 26: Laser-cut leading edge former gently inserted in rib slots

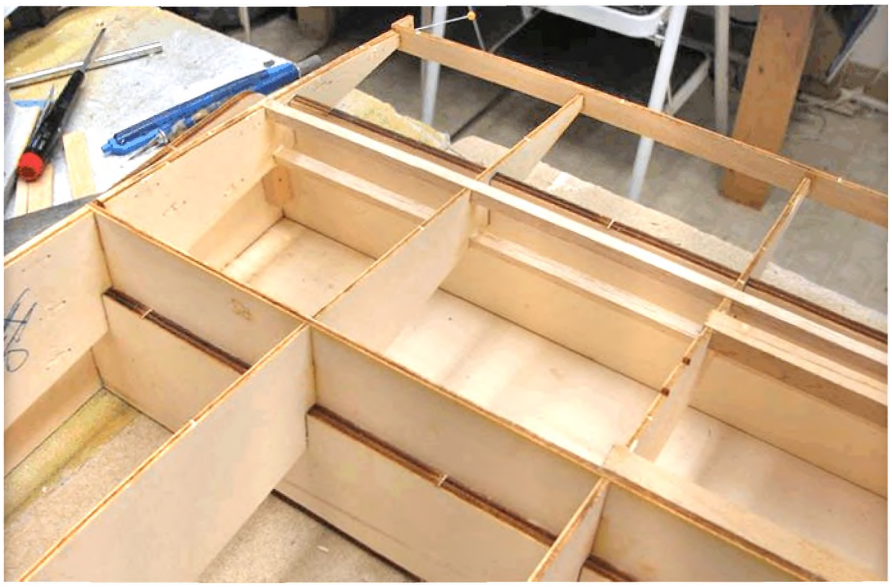

Photo 27: Center shear web is laser-cut plywood piece

Balsa and hardwood spars are glued into place (see **Photo 25**). and a plywood leading edge former is slowly inserted into the slots in each rib (see **Photo 26**). This takes a little jiggling and gentle manipulating, but it can be done. Then all you do is remove it, add the wood glue, and reinsert it all over again. Another laser-cut plywood center shear web piece is slipped into the slots at the middle of each rib (see **Photo 27**). The glue is added later.

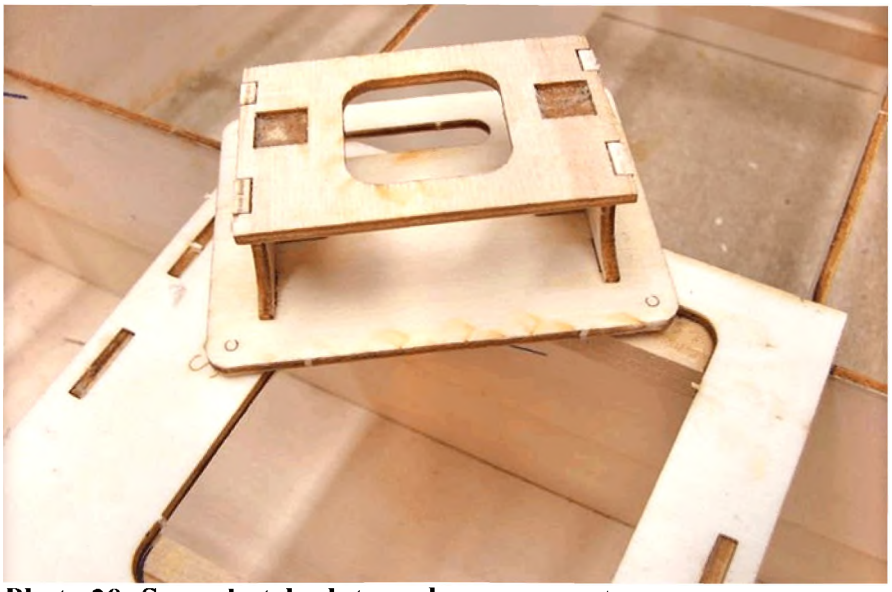

Photo 28: Servo hatch plate and servo mounts

Photo 29: Center section of wing with more ribs and sheeting

Photo 30: Front shear webbing glued and clamped

The servo mounting plates and the removable hatch covers (see **Photo 28**) are made from laser-cut plywood and hardwood legs. They have to be assembled to place the servo arms at the correct place in relation to the aileron and flap horn mounts. The section of wing that covers the fuselage is added using more laser-cut plywood parts (see **Photo 29**). Individual shear webbing is added to most of the front spar (see **Photo 30**) and is clamped during drying.

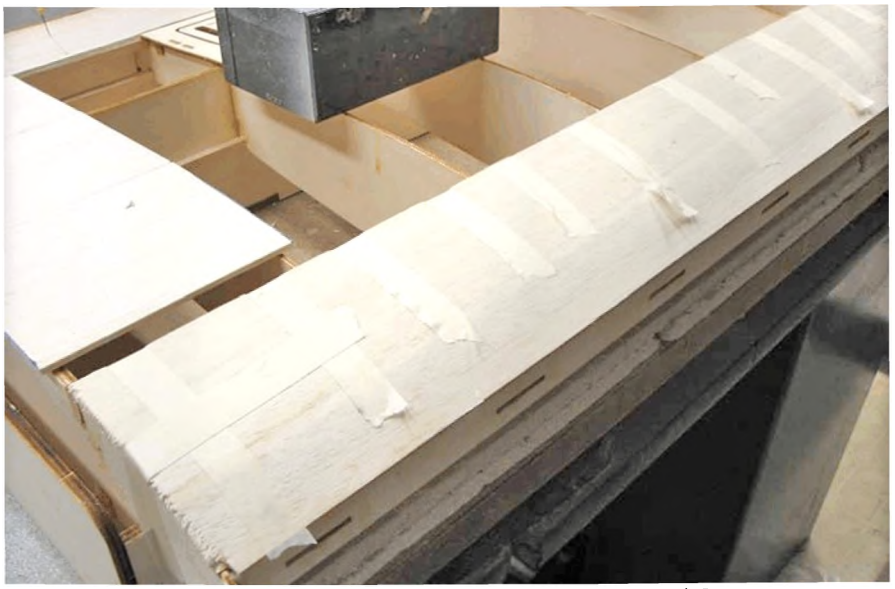

Photo 31: Leading edge sheeting glued and held with tape

Photo 32: Trailing edge installed the same way

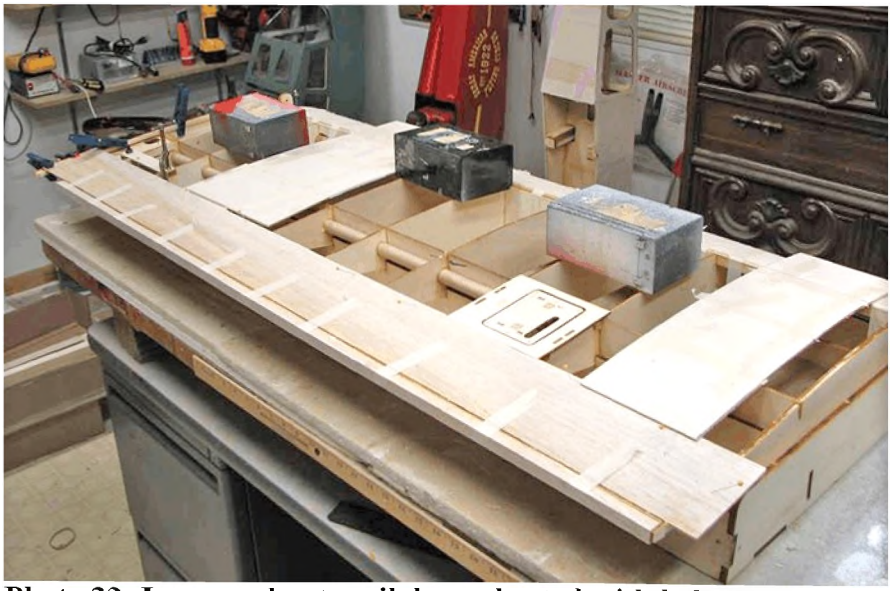

Photo 33: Inner and outer rib bays sheeted with balsa

A few laser-cut parts were missing from my kit, so I had them duplicated locally. They were simple plywood rectangles with slots, but only half the number I needed were in the kit. I also ran out of 3/8" balsa stick material, so I took some from my personal balsa sticks bin. AMR has been notified of these shortages, and they've promised to correct the problem in all future kits.

The leading edge sheeting was glued into place (see **Photo 31**) using ZAP at the leading edge, and yellow glue along the ribs and spars, using plenty of masking tape to keep things in position. I constantly checked to make sure all the ribs were completely seated in the wing jig slots, but they never moved. A trailing edge sheet was glued to the back of the wing (see **Photo 32**) and held in place with tape and pins. The center section and outer rib bay was sheeted with edge-glued balsa sheeting (see **Photo 33**).

Photo 34: Ailerons and flaps being aligned

Photo 35: Opposite side of wing being sheeted

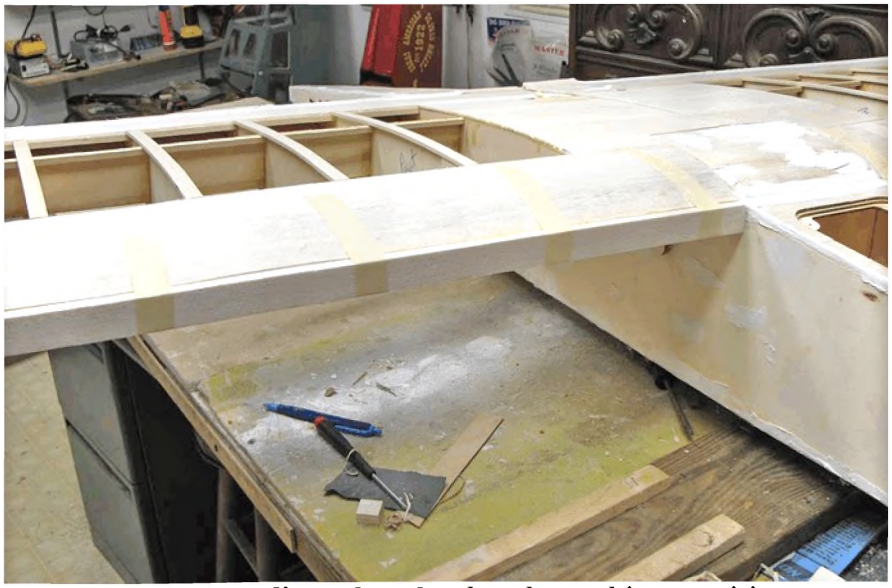

Photo 36: Wing leading edge glued and taped into position

The flaps and ailerons, with their nicely scalloped trailing edges, are not as long as the entire trailing edge (see **Photo 34**). There's a 3/8" gap at the tip rib, and again between the flap and aileron, plus about a 2" gap between the flap and fuselage side.

The wing is then gently removed from the jig and flipped over to add the pieces that go on the other side (see **Photo 35**). I used old starter batteries as weights to keep the ribs in contact with the table while the trailing edge and spars were glued in place. Once the sheeting and spars are installed, the wing will no longer fit into all the slots in the wing jig. The ribs fit into only the front and middle slots, but make sure all the ribs fit all the way into all the slots to maintain alignment.

Once the rest of the wing parts were installed, it was time to build the other panel. I reversed the wing jig end pieces, rotated the slotted rib parts 180˚, and screwed it all back together, making sure I had it right for the "other wing". This one was assembled the same way as the first, except the other way around. I also made sure to add balsa blocks at each aileron and flap hinge location, since the 1/2" trailing edge is a bit shallow for the Robart point style hinges. The leading edge was attached (see **Photo 36**) and the wing panel was ready for sanding.

Photo 37: Main landing gear and 5" DuBro wheels

Photo 38: The Ohio Superstar tail wheel assembly comes in the kit

The wedge shaped wing tip parts are glued together and attached to the tip ribs, adding the triangular alignment braces supplied.

Earlier in the manual I read that the main wing tube would be aligned to the fuselage later in the building process. Hmmm. I've not seen it, yet here I am with no more instructions. There's no mention about squaring the wing to the tail or fuselage, there's no mention about cutting a access hole for the servo leads or wing bolts, not a word about the recommended control linkages, using reversed servos, the fuel system.... the instructions manual must have run out of ink and pages! The builder is now on his own. I don't like this, but with a kit of this size, I'm hoping the builder has considerable building experience

Now on my own, I installed the main gear, wheels, and axles. Not much to do here except add the bolts, install the axles, and tighten everything. The DuBro 5" wheels look pretty good, and the gear legs are very sturdy looking (see **Photo 37**). I mounted the tail wheel on the fuselage even though the stab has to be mounted between the leaf spring and the fuselage bottom. This also seemed like a good time to align the stab with the fuselage. I made some marks on the stab where it will be placed permanently after covering, and drilled holes through the hard points for the tail wheel leaf spring. So far everything lines up pretty well.

The tail wheel is an Ohio Superstar unit (see **Photo 38)** designed to be controlled either by springs to the rudder horn or by a pull-pull cable system. In this model's case, the rudder is above the stab and the tail wheel tiller bar below, so I decided to use two separate pull-pull cable systems, one on top of the fuselage for the rudder, and another underneath for the tail wheel. There are cut-outs in the top and bottom sheeting for the wires, which will be installed after the covering is complete.

I then took all the sub-assemblies outside for sanding. Coarse sandpaper was used to take off the larger irregularities, and the Master Airscrew razor plane was used to roughly shape the wing's leading ed-

Photo 39: Wing panels temporarily mounted to fuselage

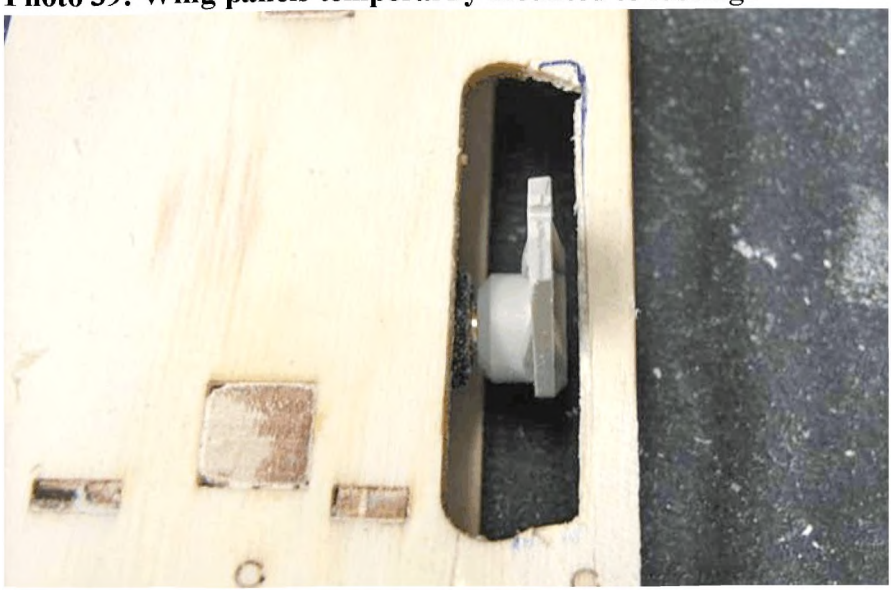

Photo 40: Modification to wing servo mounts for large servo arms

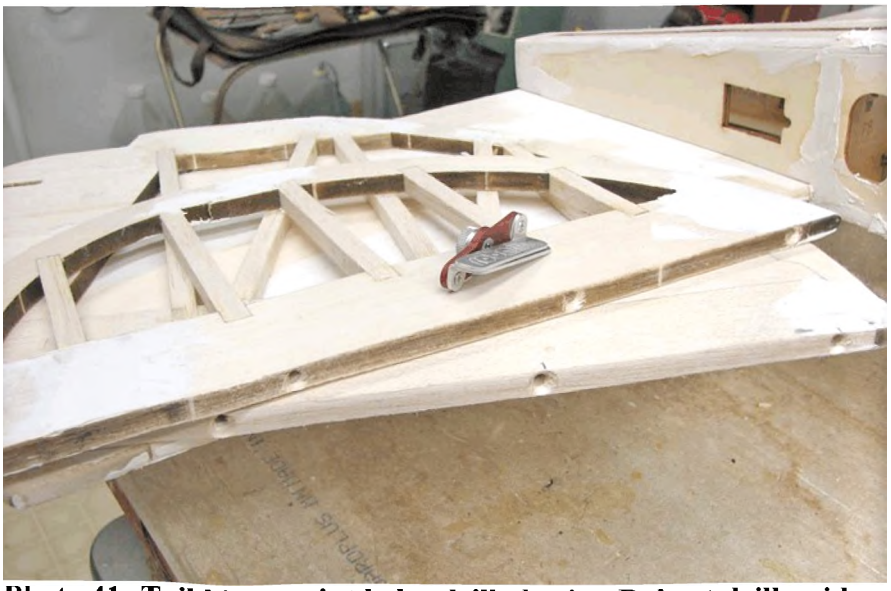

Photo 41: Tail hinge point holes drilled using Robart drill guide

ges. Finer sandpaper was then used to dress the surfaces to a presentable smoothness, after which I filled all the low spots with lightweight filler... and more sanding.

When mounting the wing I drilled the holes through the top sheeting where the wing bolts go through, and holes in the lower sheeting for the aileron and flap servo leads. After the aluminum wing joiner tube was slipped through the tube in the fuselage, each wing panel was slid on (see **Photo 39**) and the alignment checked, I drilled a hole through the rear wing bolt bracket and into the wing bolt plate in the fuselage. Holes for blind nuts were drilled, and the nuts installed. Then the wing panels were re-installed, and after a little sanding and filling, the center joint looked pretty good.

I tried to install one of the servos I planned to use for the flaps and ailerons, only to find that the laser-cut servo arm slots required quite a bit of trimming to clear my DuBro Heavy Duty servo arms (see **Photo 40**). Standard servo arms will fit the slots fine, but I don't recommend their use on a plane this big and heavy.

The stab, fin, rudder, elevators, ailerons, flaps, and wing trailing edges can now be drilled for their hinge points using a 3/16" drill and the Robart Drill Guide (see **Photo 41**), followed by a countersink bit to enlarge just the outer end of the holes for the hinge joint.

Photo 42: Here the Zenoah G-62 Lite is test fitted on the firewall

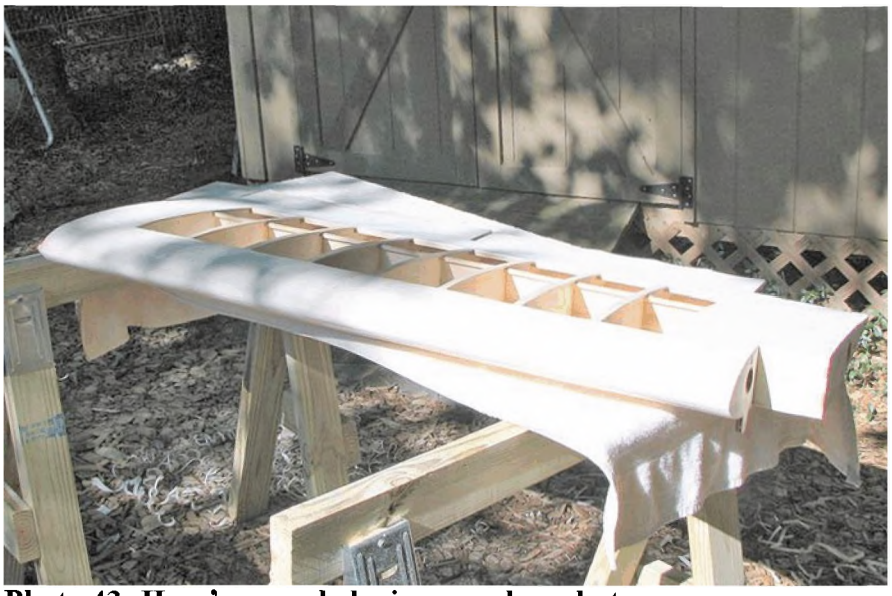

Photo 43: Here's a sanded wing panel ready to cover

After the holes were done, the leading edges of the control surfaces were beveled using the razor plane. The hardwood dowel control horn mounts can be glued into place, but that limits the type of control horns that can be used. DuBro Heavy Duty horns use a bolt that extends through the control surface, and I had some hanging on the wall in my shop.

The firewall looks pitiful without an engine, so that's where I went next. The engine I'd planned to use was still not available, so I borrowed a new Zenoah G-62 Lite (see **Photo 42**), modified by Ralph Cunningham by adding an electronic ignition and removing some weight. Rick Cawley loaned me the engine until mine arrives. Rick's a kind and generous guy, who also realizes that I'll run the engine enough to break it in for him. Smart!

I marked and drilled the mounting holes for the engine on the firewall, and used bolts and lock washers inserted from the inside to hold it in place. I also marked and drilled holes for the throttle linkage, fuel lines, and spark system battery wire. Then I assembled a DuBro 24 oz. gas tank with a gasoline-compatible stopper and lines. One of the DuBro E-Z Fill fuel fillers was placed on the side of the fuselage, even though I could easily get to the fuel line right next to the engine. I then remembered that I had seen a nice shelf in fuselage that had slots for hook and loop fasteners to hold a fuel tank. I also remembered covering that area with balsa sheeting as described in the manual. It would have been a perfect place for the fuel tank, just ahead of the CG, but now the tank will have to go in the front hatch, along with the ignition box. The batteries will be later positioned where needed to balance the completed plane.

I'm guessing now that everything is done, since there are no more parts in the box, and I ran out of instructions long ago. So, it was time to take everything outside, set up my sanding table, and begin removing anything that doesn't look like it belongs on a giant Ugly Stick! I had already filled in most of the low spots, allowing the filler to completely dry for several days.

Six hours, several sheets of sandpaper, and two tired arms later, the airframe was all nice and smooth (see **Photo 43**).

Photo 44: The by-products of my razor plane and sandpaper.

Photo 45: The completed airframe is now just under 19 lbs.

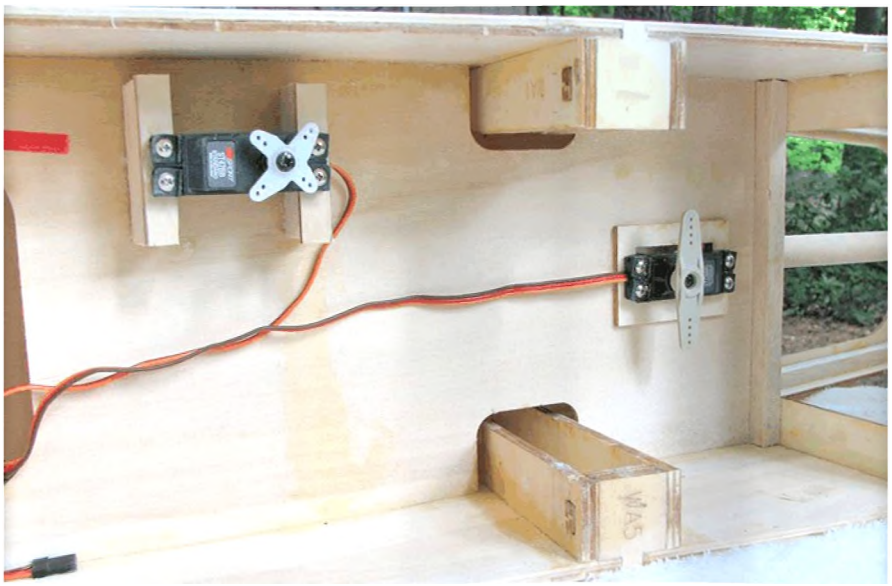

Photo 46: The throttle servo (left) and rudder servo on the floor

Where did all the rough edges go? See **Photo 44**.

I then decided to put everything together to see what it looked like uncovered (see **Photo 45**). Then I took all the pieces back into the shop and began installing the servos. The throttle and rudder servos mount on the main floor board (see **Photo 46**) but that's when I noticed that the neat cardboard tube that runs from the tail to the radio compartment was *under* the floor board, and practically unusable now. I made some preliminary measurements for the control rods and servo extensions, but I'll wait until after the plane is covered to finish and install them.

After brushing, blowing, and otherwise removing all the dust from the airframe, I began applying the Hangar 9 Ultra-Cote covering. I cut all the different panels to size, and covered all the control surfaces first. The ailerons, flaps, and elevators all have those neat looking scallops on their trailing edges, but they're a pain to cover neatly. With enough heat and encouragement, however, they all got covered. I then applied the white covering to the wing panels first. Then the red inner wing sections, the wing tips, and finally the fuselage.

Photo 47: Voila! A completely covered Giant Stick 50.

Photo 48: The rudder pull-pull cables at the rudder control horns

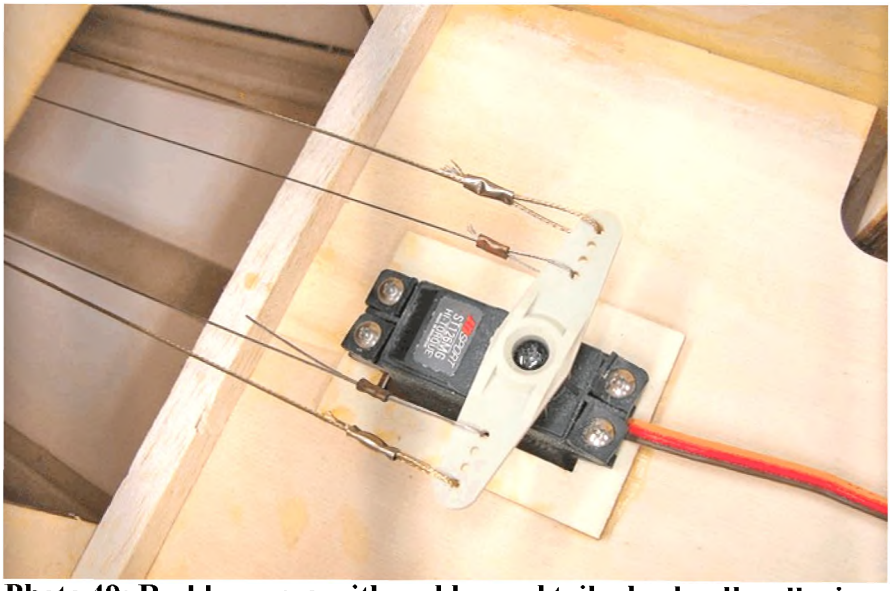

Photo 49: Rudder servo with rudder and tail wheel pull-pull wires

This is what it looks like inside the shop, needing only the last piece of white covering (see **Photo 47**). I started at 7:00 a.m. on Saturday, and had the plane completely covered by noon Sunday. And yes, I did sleep a bit late Saturday night.

Back to the control linkage installation, and here's the rudder pull-pull at the rear end (see **Photo 48**). There's a second set of wires from the rudder servo on the bottom of the fuselage that connects to the tail wheel assembly. At the rudder servo, the two sets of wires connect with the rudder controls on the outside for more movement, and the tailwheel cables inside for less movement (see **Photo 49**).

Photo 50: Aileron servo arm and linkage

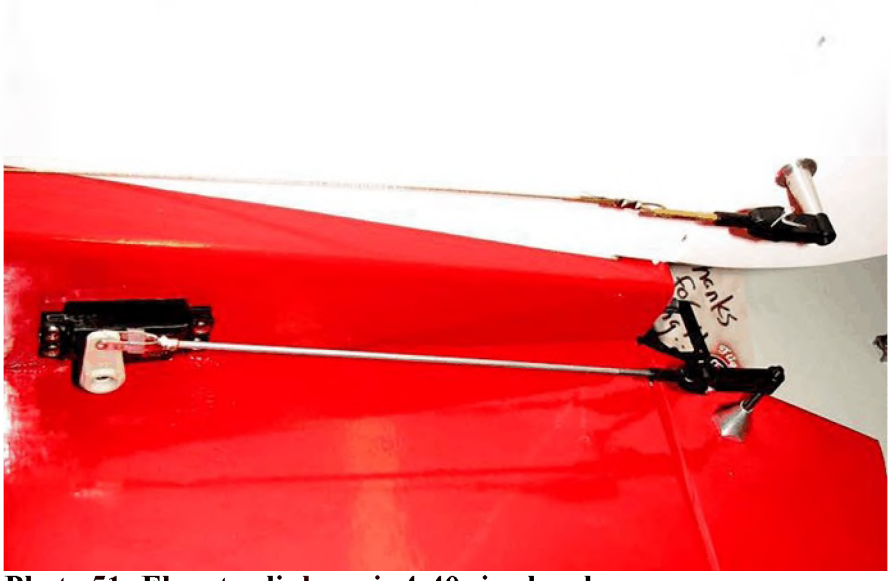

Photo 51: Elevator linkage is 4-40 size hardware

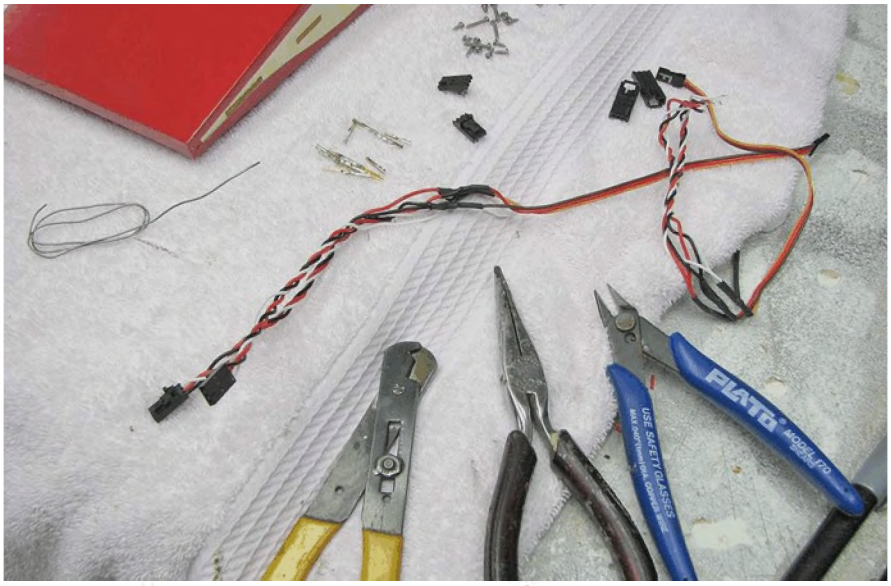

Photo 52: I make my own servo extensions and Y-harnesses

The aileron linkage is a 4-40 rod with DuBro soldered clevises connected to the DuBro heavy duty servo arms that stick outside the wing through the servo mounting plates (see **Photo 50**). The elevator linkage (see **Photo 51**) looks about the same, again using soldered clevises at the servo end, and DuBro Heavy Duty horns at the control surface end. I make my own servo extension leads and Y-harnesses (see **Photo 52**). Twisted 20 gauge stranded wire is used for the leads, and all solder connections are protected by shrink tubing.

When I started to run the servo extension leads from the elevator servos to the radio compartment, I'd planned to use that handy cardboard tube installed during fuselage construction. But not only was the front end of it hidden by the floorboard, the rear end of it was blocked by a former with no hole in it! I had to drill a 1/4" hole through the former, and pass the servo extension lead through it to the front. The cardboard tube in the fuselage seemed like a good idea on paper, but it wasn't carried out well. Those in the wing panels, however, worked just fine.

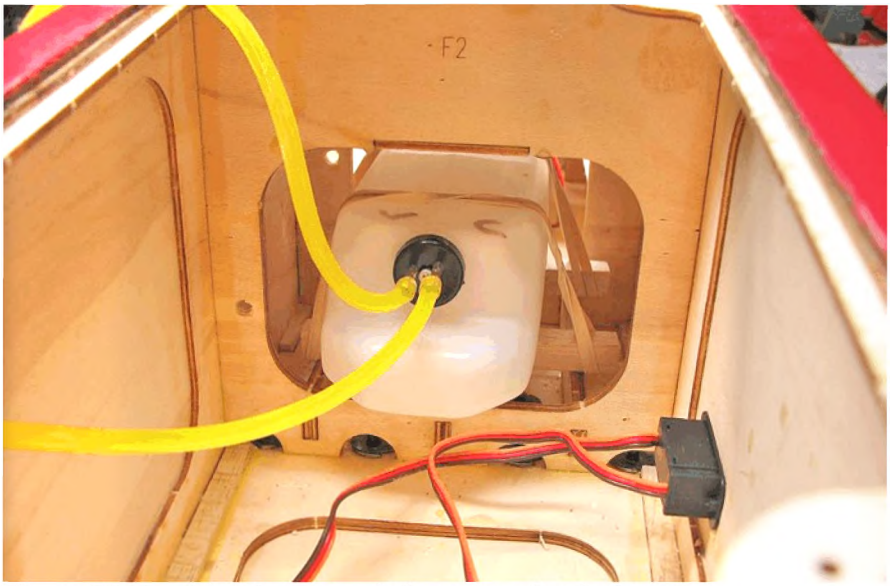

Photo 53: Ignition battery sitting atop the fuel tank

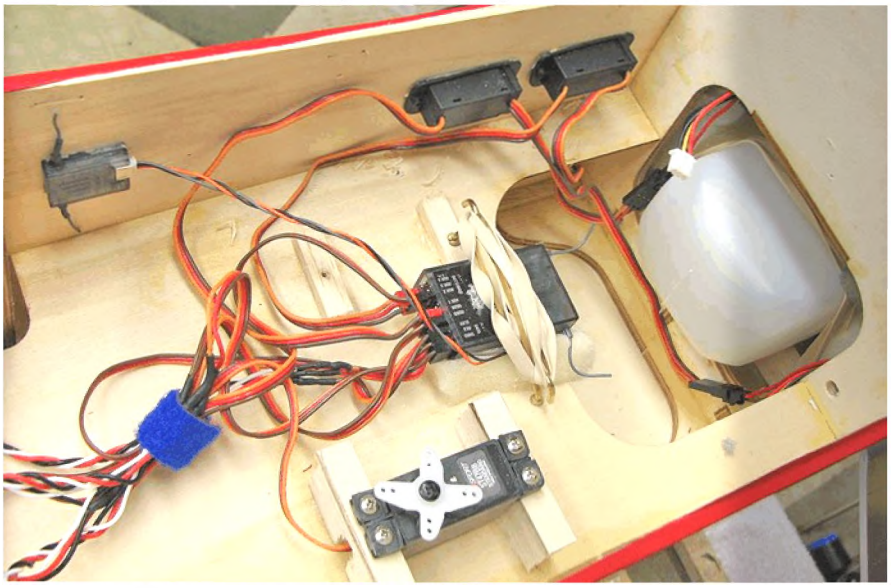

Photo 54: Receiver and power switches

Photo 55: My added plywood plate to reinforce landing gear mount

I Zap'd a few hardwood sticks across the main gear braces, and mounted the 24 oz. gas tank wrapped in sponge with several rubber bands. The ignition switch was mounted on the side of the *cavernous* front compartment, and the ignition battery was mounted on the floor (see **Photo 53**). The receiver and battery switches were mounted on the fuselage as seen in **Photo 54**. I'm using two 2-cell 2300 mah receiver batteries, and one 2-cell 1100 mah A123 ignition battery, used with a homemade LDO voltage regulator.

My Giant Stick 50 is now about ready to fly. Everything is pretty much complete, when I suddenly receive an email from AMR Kits with a suggested modification to the main gear mounting plate. This changes one of the very early construction steps. Now they want the builder to replace the supplied plywood that the gear legs mount to, and use a piece of 1/4" thick aircraft plywood instead. At this point for my model, this is just about impossible. So, I cut a piece of 1/4" aircraft plywood to fit between the gear legs and the fuselage bottom, tapered the front and rear, drilled the bolt holes, and covered it with matching UltraCote. It was then epoxied in place so that the gear legs, when bolted down tight, act as clamps to keep the new part tight against the fuselage. I hope it will work okay (see **Photo 55**).

I assembled the Giant Stick 50 outside in my engine test area to run the engine and set the control surface throws. Once the gas tank was filled, the choke was applied and the engine sprang to life after just a few flips. It turned the Vess 22B prop at more than 7500 RPM using the J'TEC side mount muffler (see **Photo 56**). I had the batteries installed near the recommended CG, which I feel may be too far back for a maiden flight. I decided to move the batteries just a wee bit forward to set the CG at 30%, just to provide a little insurance for that all important first flight.

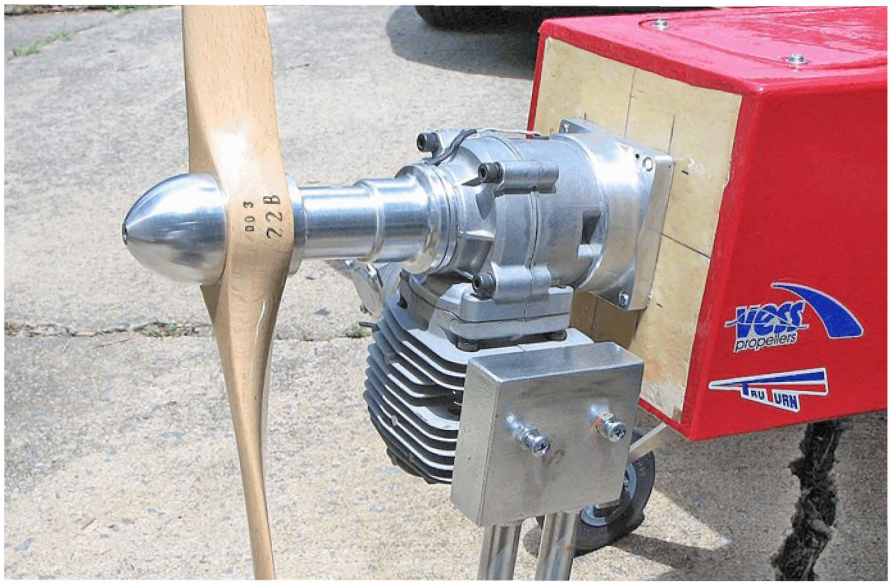

Photo 56: The Zenoah G-62 Lite with a Vess 22x8 prop and a J'TEC side-mount muffler makes a plenty potent power package.

My AMR Giant Stick 50 then weighed 23 lbs. and 8 oz. dry. This is 18% higher than the 20 lb. Figure listed on the AMR website, and on the instructions manual's cover. Still, with so much wing area (which is 216 sq.in. less than advertised!), the wing loading is only a tick above 21 oz./sq.ft., a true indication of a real floater. If this thing was any lighter, it might thermal like a glider!

All I needed now were the large black Maltese Crosses for the wings and fuselage, and AMR is going to laser-cut them for me. They plan to make them available for all their Stick models, but they can also cut them to the builder's dimensions.

The crosses arrived in a few days and were applied using the "wet method" with window cleaner and a balsa squeegee. The few bubbles that remained were removed with a pin point and rubbed down with a finger nail. Once the entire model was inspected several times, it was assembled outside again in the engine test area to set the carburetor, complete a radio range check, and check out its ground handling (I drive it up and down the street a few times for this.)

The engine started easily and the needles were already close to ideal. The results of the radio range check said "go fly". Taxiing the model around the yard through the tall grass (I'll have to speak with Gerry about her mowing habits) showed that there was be plenty of power and adequate ground handling. After adjusting the tail wheel a little, the plane taxied up and down the street easily with plenty of turning power.

With no tests or inspections left to perform, it was time to pack the Giant Stick 50 into the trailer and head for the flying field.

And so, that concludes Part II, the construction process of this review. For the flight tests and overall review (with summary) of the AMR Giant Stick 50 kit, see Part I in last month's August issue.

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A kindergarten teacher was observing her class of children while they were drawing, and was walking around to observe each child's work. As she came to one little girl who was working diligently, she asked what the drawing was. The little girl replied, "I'm drawing a picture of God."

At that the teacher paused and said, "But no one knows what God looks like." And without missing a beat or even looking up from her drawing, the little girl replied, "Well they will when I'm done."