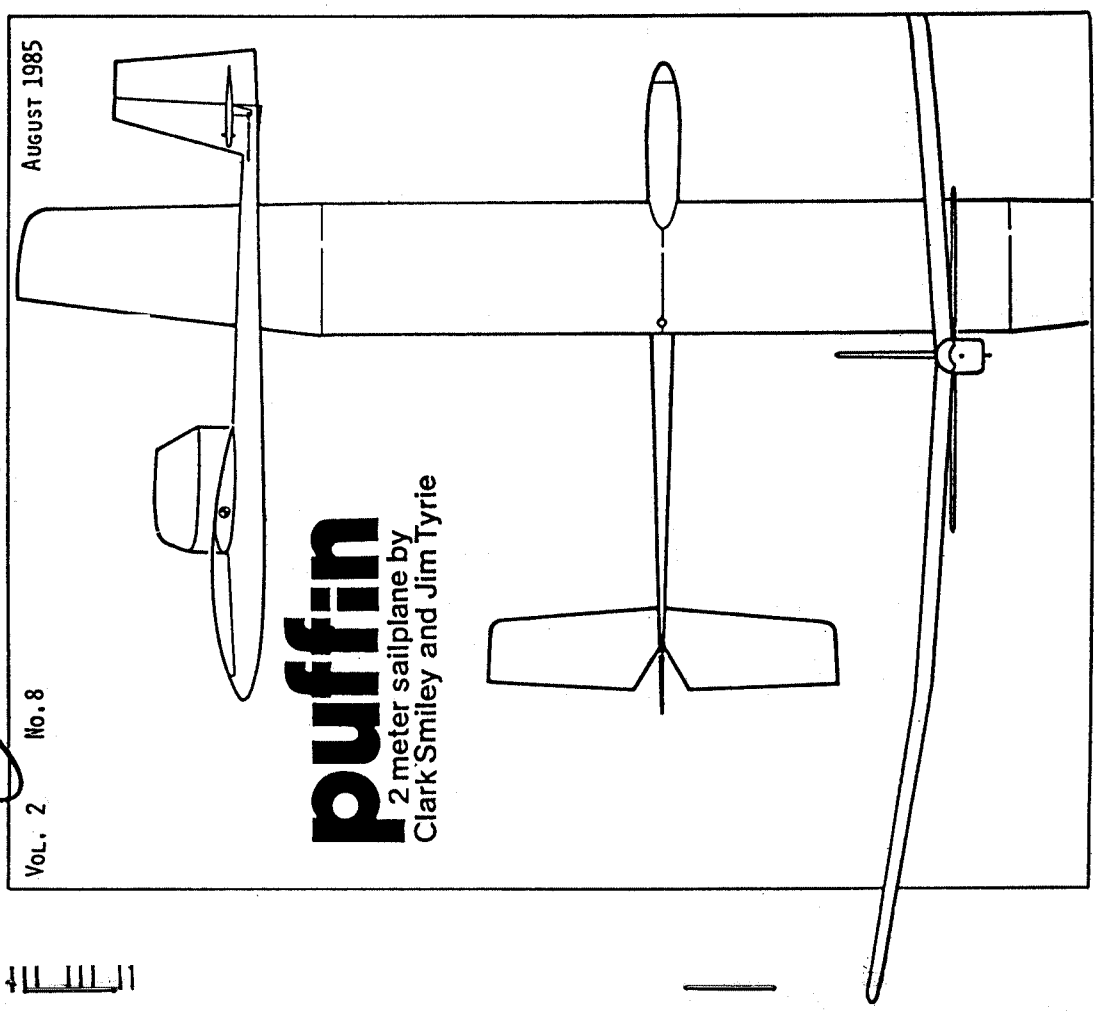
VOL. 2 No. 8 AUGUST 1985

puffin

2 meter sailplane by
Clark Smiley and Jim Tyrie



RC Soaring Digest
P.O. Box 269
Peterborough, NH 03458

If you're an eight-to-fiver, Monday through Friday, like me you've possibly noticed that all the good soaring days come during the week days. Monday starts out sunny and bright - and by noon the cu are popping everywhere. Lift abounds until just before you can come home, change your clothes and get out to the field. Yep.

Now, take weekends, for instance. If you have some time off, they will be grey and dull - maybe even rainy. Possibly too windy, or just plain impossible. If, by chance, you should luck out and get a nice day, I'll bet that you have to visit the mother-in-law, or do some shopping, or get the lawn mower fixed and mow the grass.

What are we going to do about it? I've got some ideas, and something I want to get off my chest, so put your feet up and lend an ear.

There used to be an adage among sailplane pilots: "Don't wait for better weather; if what you have now is soarable, go for it!" Apply that to life, and you've got a pragmatic, action formula for living, so let's see where that takes us.

Recently, I heard some pretty ugly rumors about the place where I work as an eight-to-fiver. There's talk of closing the place down, of transferring employees out of town, of making 'economic' cutbacks. This isn't new, but there's a ring of truth to it this time, and I know the feeling, because it happened to me once before - about 10 years ago. Now it looks like it's happening all over again, so what do I do: hang in there until the bitter end, or grab the ol' rip cord and bail out now?

It seems to me that there must be some good way way for you and me to balance the requirement for earning a living with the desire (or need, if you're like me) to enjoy some of the better things in life more frequently. To come and go more or less as you please, yet pay at least lip service to the Puritan work ethic. There has to be a way to achieve a nearly ideal combination of work and play, and I envy those whose work IS their play. They're the 'lucky' ones...or are they? Maybe it isn't luck, after all; perhaps it's good planning.

RCSD is something like that for me. I look forward to creating every issue: the planning, the layout, the typing; the little task of selecting the right balance of material and putting it into visible form for you to enjoy. It's FUN, not work, yet it takes time. I guess it depends upon viewpoint and attitude, yet I can see the possibility that there must be other ways to work and play at the same time, and this is where YOU come into the picture. I need ideas and suggestions for combining all those things I enjoy into a tapestry of work and play, preferably at the same time. Get the picture?

I fancy myself a communicator; writing, talking, working ham radio, translating foreign languages, troubleshooting, engineering, writing patent applications...all things that I've done. For the last eight years, I've been in the publishing game, and right now I sell advertising space. All of these require communication with people, and it's enjoyable. Similarly, if not identically, there's something for you, too...a way to amalgamate work and pleasure. Let's put our minds to it and figure out a way to apply that action formula. Let's not wait for Utopia to come to us, but instead go for it!

Jim

PUFFIN ..... Clark Smiley and Jim Tyrie

This two-meter sailplane looks much like many other two-meter sailplanes you have seen: it has a fairly standard fuselage and tail group, a conventional polyhedral wing of one-piece construction, and some pretty much bread-and-butter construction methods in wood and plastic. The question, then, is WHY the PUFFIN at all, and how does it differ from other designs. First, some details: it has a span of 78-3/4" and a flying weight, without ballast, of about 32 ounces. It uses a Mike Bame airfoil of 15% thickness, and can be ballasted as needed. The wing is a straight-forward balsa rib, spruce spar, balsa shear web, design and is very strong due in part to the sheeted D-tube construction and very generous spar depth. In Jim's version, some carbon fiber is used, while in Clark's version, there is none. Then, after you've looked it over for awhile, you begin to notice some pretty sophisticated aspects; things like the unique wing hold-down method (featured in RCSD a few issues back); the extremely clean design with no protrusions; a nice canopy fit; the plywood fuselage; the light, but adequate tail structure; the relatively thick stabilizer section; the unique tow hook arrangement that is part of the wing hold-down system; and the overall business-like appearance of the overall concept. Not dainty, not brutish. Just clean, efficient and 'together.' An integrated design concept that works right because it looks right and is right.

I had the opportunity today to see the PUFFIN fly in winds that would have kept other machines on the ground. Jim, for example, flew his without ballast in 20-knot winds, and managed to launch high and stay up in turbulent,gusty air...not enough for a ten-minute max, maybe. but certainly better than the other machines did. Clark added ballast to his version (which has a slightly greater dihedral) and did as well as Jim in the rotten conditions.

The one-piece wing and hold-down combination permit assembly in seconds (when you don't have to use a flat-blade screwdriver on Phillips-head screws). There is virtually nothing protruding where it shouldn't be, and the antenna is buried within the fuselage, where all good antennas should be. The ship is strong, and can withstand a winch zoom launch. This is partly because of the generous spar depth (due to the 15% thick airfoil) and partly because of the materials used and the way they are put together.

The PUFFIN has evolved over a two-year period, and right now is probably as good as any two-meter sailplane I know about. There could be a further improvement if the Selig improvement of the Bame airfoil is made; an improvement in penetration (which is already excellent) through an even lower drag airfoil which doesn't sacrifice lift.

Several Beta-test models are out in the field now, and - if the boys are satisfied that these tests live up to their expectations - it is entirely possible that the ship may be kitted...something that I, personally, would really like to see. There is only one problem with that: it would make everyone as competetive as I hope to become with my own PUFFIN.

Jim Gray

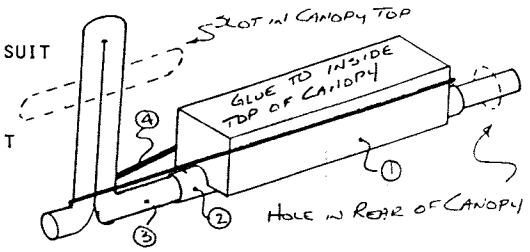
Canopy Hold-down system.....Jack Cash (not Johnny Cash)

Enclosed is a sketch of the canopy hold-down system used by Jack Cash, who claims that it is effective, positive, easy to build/install and can be made from scrap material; i.e., 'cheap', which just about covers its advantages.

10317 Old Annapolis Road
Walkersville, MD 21793

Materials needed:

(1) 1/4" x 1/4" balsa, length to suit
(2) 1/8" brass tube, 1'2" longer than the balsa
(3) Metal pushrod - length to suit
(4) No. 8 Rubber band



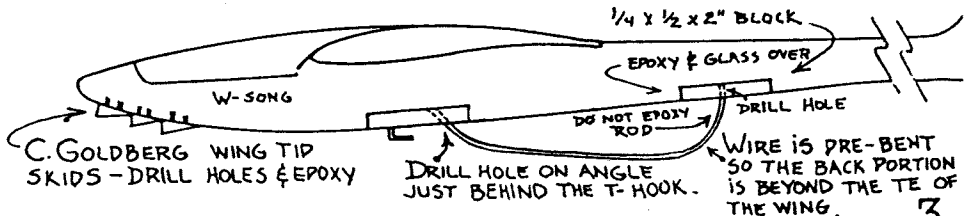
Here's How:

1. Slot the balsa to accept the tube; glue in place with CA
2. Bend the wire to the shape shown. The height should be sufficient to extend through the canopy. Length should be sufficient to extend through the canopy and into the fuselage.
3. Assemble and wrap a No. 8 rubber band around the assembly.
4. Slot the canopy top and drill the rear of the canopy to accept the assembly.
5. Glue the assembly to the inside top of the canopy.
6. Trim the wire so that it is flush with the rear of the canopy in the 'release' position.
6. Use the canopy to mark the fuselage for the hole position.

Helpful Hints to stop sliding sailplanes...Rich Bonnell

You've probably had the problem of trying to spot land your ship and having it slide right through the spot, and sometimes on out of the landing circle, for a zero score! DRAT. Rich Bonnell has come up with a really good stopper that will bring your sailplane to a screeching halt right now, and right where you want it. Rich installs it on the WINDSONG sailplanes that he uses himself, and on the ones he builds for others. It's a great idea and a clever piece of work - yet simple to make and install.

Goldberg wing-tip skids of plastic are epoxied into drilled holes in the nose of the sailplane as shown in the sketch below, and the wire skid under the fuselage keeps the nose down on landing so the plastic skids on the nose will bite.



Simons Says.....Martin Simons

A few weeks ago my friend Martin Simons, University of Adelaide, South Australia, sent me some information that I'm just now getting around to sharing with you. He has published a couple of small brochures or pamphlets that he calls F3B Technical Note, Number 1, and F3B Technical Note, Number 2. With Martin's kind permission I'd like to excerpt some of the material for your interest and possible use.

"A new book, Volume 2 of Dieter Althaus's Profilpolaren fur den Modellflug has recently been published in Germany.*

"It is interesting to find that the Clark Y airfoil has been re-tested with results slightly less favorable than those published in the earlier book. The reason for the variation is not known yet.

"...Even so, the old Clark Y still shows up remarkably well for the ordinary 'club' soaring sailplane. Only one other profile comes out of the wind tunnel (so far) with marginally better figures for slow flight and thermalling; that is the Eppler 211. This Eppler profile looks good for the large, cross-country sailplane which will not be required to fly very fast. The Clark Y will still give it a hard time in weak lift!

"Another fascinating experiment was designed to test the hypothesis that covering a model wing with paper, or film, or sheet balsa, makes a difference to its flight characteristics. The profile tested was Eppler 374, the plain airfoil smooth as it would be on a carefully built model, the same covered with paper, then with film, and finally a built-up wooden wing with balsa sheet leading edge and sagging covering behind the spar. The built-up structure comes out worst all over but not bad at the slowest speeds; the film-covered solid wing is noticeably better than this at all speeds. The paper-covered solid wing does not do very well at low speeds, but improves a little as it goes faster, just surpassing the fim-covered wing at high speeds. The plain, smooth wing is worst of all at low speeds, but improves and is best of all at high speeds, crossing over at about the velocity of an F3B model in a distance task or a slow speed run. The implication is that for speed tasks accuracy and smoothness of the section is important, but the slower you go, the less it matters. We knew that before, but it is confirmed here again.

"...The true aerodynamic center (where the lift acts) is further forward than we have hitherto thought. The difference may be two or three percent, maybe more. . .the center of gravity should be adjusted to allow for this. The effect on performance will not be great, but the handling qualities are affected considerably by the c.g. position, as is well known." Martin's study continues with information about the Quabeck airfoils which have now been tested against Gottingen and Wortmann profiles. Results are shown and discussed. In technical note 2, Martin discusses the new Girsberger airfoils reported on by Guy Revel in the French Modele Magazine.

* Neckar Verlag, Klosterring 1, 7730 Villingen-Schwenningen, West Germany

Simons Says (continued)...

"What follows is a translation by M. Simons from a brief report written in German by Rolf Girsberger himself. (Rolf Girsberger lives in Switzerland at Ehrendingerstrasse 29, CH 5400 Ennetbaden).He understands English, and may be ready to answer enquiries about his new profiles.

"...The Eppler 180 has been used on many fast RC sailplanes and is excellent. Its disadvantage is the very small maximum lift. Based on experience with this, the new profiles were developed to meet the following objectives:

A) Profile drag at small lift coefficients equal to E180.
B) The lower limit of the low-drag range at small negative lift coefficients.
C) The maximum lift coefficient higher than E180.
D) The critical Reynolds Number well below 100,000.
E) The pitching moment coefficient is permitted to be more than the E180, but less than the E193.
F) Profile thickness between 8.5% and 9.5% of the chord.

"The three profiles 12, 14 & 15 meet these objectives. They were calculated using the Eppler computer program.

"...the polars of these profiles, in comparison with the E180, have a less marked upper limit to the laminar low drag range. . . the maximum lift coefficients lie between 0.9 and 1.0. This is superior to the E180.

"The calculations show that some laminar separation on the underside, increasing the drag, cannot be avoided entirely. "

Profiles are shown, as are coordinates, and characteristic data. These are compared with those of the E180.

"The program parameters for the upper surfaces of the profiles were chosen so that the theoretical transition point of the boundary layer moves steadily toward the leading edge as the angle of attack increases. For this reason the polars of these profiles, in comparison with the E180, have a less marled upper limit to the laminar low-drag range. On the undersides the parameters were chosen so that the extent of the laminar boundary layer varies only slightly in the in the range of angles of attack appropriate for fast flight. . . at small negative angles of attack the transition point moves rapidly toward the leading edge. This is the reason for the marked lower limit of the laminar low drag range."

Comments by Simons: (paraphrased)

We may conclude from these data that the Girsberger profiles may well prove to be excellent for all of the F3B tasks, especially the speed task. However, Simons points out that the Eppler theoretical data are worked out for airfoils at fairly high Reynolds Numbers, and it is not safe to rely on the calculated figures for the low and moderate speeds at which the models fly in soaring and distance tasks. Differences between the Girsberger profiles and the Epplers will tend to show up in the low-speed figures, and will perhaps only be detectable in actual practice. In the absence of wind tunnel tests, the only way to really find out if they are superior, is to build a suitable wing and test it against the others.

TECH TIPS .....Max Chernoff

Max Strikes Again.....this time, it's variation in control surface deflection. He writes:

"...I elected to make a study of numerical variation in control surface inclinations depending on location of clevis. I selected vertical variations in accordance with my observations, and horizontal locations for most control surfaces that I have observed. The maximum control point movement was predicated by a 45-degree roatation of the servo control arm on a mini servo. Note that using a larger horn does NOT improve the differential angular motion for the same actuation motion. Moving the clevis aft DOES improve the deflection upward, but also physically limits upper bounds of motion. The only drawback to the smaller horn is that the control at the transmitter is more sensitive. However, with modern equipment, the lower rate can be put as input (dual-rate systems, e.g.).

"P.S.: Drag due to a larger horn can be very significant. The best solution would be to actuate by torque tube as the Germans do it and as Airtronics does it in their ADANTE."

Regards, Max

VARIATION IN CONTROL SURFACE DEFLECTIONS

In following tables results are shown for differential control surface inclinations with variation in:

A: chordwise location of actuation point

B: vertical location of actuation point

C: motion of clevis

It is assumed that horn is on lower side of surface and that there is common point for actuation on common servo or if seperate servos are used arm is at crosswise position on both.

The symbols shown on tables are :

HZ = vertical distance between hinge line and clevis point in inches

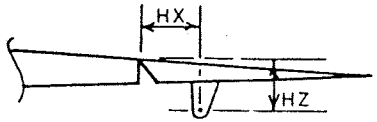
HX = chordwise distance (aft) between hinge line and clevis point in inches

DX = horizontal motion of clevis point forward or aft in inches

AU = deflection of up motion in degrees

AL = deflection of down motion in degrees

Maximum value of DX chosen occurs approximately when servo arm has rotated 45 degrees for mini-servo



HZ=.50

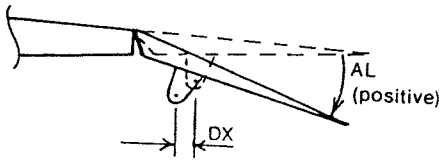
DX	HX = .25		.50		.75	
	AU	AL	AU	AL	AU	AL
.03	-3.50	3.39	-3.55	3.34	-3.60	3.30
.04	-4.69	4.49	-4.79	4.42	-4.90	4.35
.05	-5.89	5.60	-6.06	5.48	-6.24	5.37
.075	-8.99	8.48	-9.44	8.06	-9.93	7.83
.10	-15.98	11.00	-13.05	10.55	-14.24	10.17
.20	-27.04	21.43	-36.85	19.89	----	18.72
.30	-52.85	31.69	---	28.57	----	26.37
.40	----	42.12	----	36.87	----	33.47

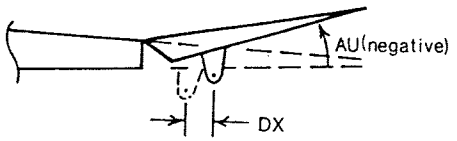
HZ=.75

DX	HX= .25		.50		.75	
	AU	AL	AU	AL	AU	AL
.03	-2.31	2.28	-2.33	2.26	-2.34	2.25
.04	-3.09	3.03	-3.12	3.01	-3.14	2.98
.05	-3.87	3.77	-3.91	3.74	-3.96	3.70
.075	-5.84	5.64	-5.95	5.56	-6.06	5.48
.10	-7.85	7.49	-8.03	7.34	-8.26	7.21
.20	-16.26	14.81	-17.26	14.25	-18.60	13.77
.30	-25.65	22.05	-28.07	20.87	-42.43	19.89
.40	-36.87	29.37	-53.17	27.32	----	25.73

HZ=1.00

DX	HX= .25		.50		.75	
	AU	AL	AU	AL	AU	AL
.03	-1.72	1.72	-1.73	1.71	-1.74	1.70
.04	-2.30	2.29	-2.32	2.27	-2.33	2.26
.05	-2.88	2.85	-2.91	2.83	-2.92	2.81
.075	-4.34	4.25	-4.38	4.22	-4.43	4.19
.10	-5.81	5.67	-5.90	5.59	-5.97	5.54
.20	-11.85	11.26	-12.20	11.00	-12.59	10.77
.30	-18.21	16.82	-19.12	16.25	-20.27	15.77
.40	-25.05	22.40	-27.05	24.73	-30.06	20.61





THE ALBUQUERQUE CONNECTION Ken Simmonds

Sailplane Structural Improvements

by Ken Simmonds

Randy's excellent recent Spoiler article "Broken Noses, Flutter, and Short Moments' sparked off a few thoughts on general sailplane design and the structural improvements which can dramatically add to the life of a typical competition sailplane. Every kit manufacturer is concerned about keeping the price of his models comparable with other similar kits on the market. He does this by minimizing the number of parts in his kit, and therefore the amount of labor required to prepare it. My contention is that by carefully considering the weak points in a kit design and adding a minimal amount of spruce, ply, carbon fiber, and glasscloth we can extend the life of the average model by many years.

The "open taco shell" forward fuselage design mentioned by Randy is a good case in point, and is common to a number of sailplane designs, including the Sagitta. The problem is that the design lacks rigidity, and the 1/8" liteply material used lacks the flexibility to withstand sudden distortions due to landing loads.

Imagine a sharp blow under the fuselage nose due to a hard landing. The open box structure is not braced on the top and so the sides tend to bulge between the fuselage formers. Similarly, in a ground loop or side loading situation the fuselage tends to bend to one side of 'lozenge'. In either case, if the structural limits of the liteply are exceeded the fuselage sides will break, probably as a tension failure on the outside of the bend.

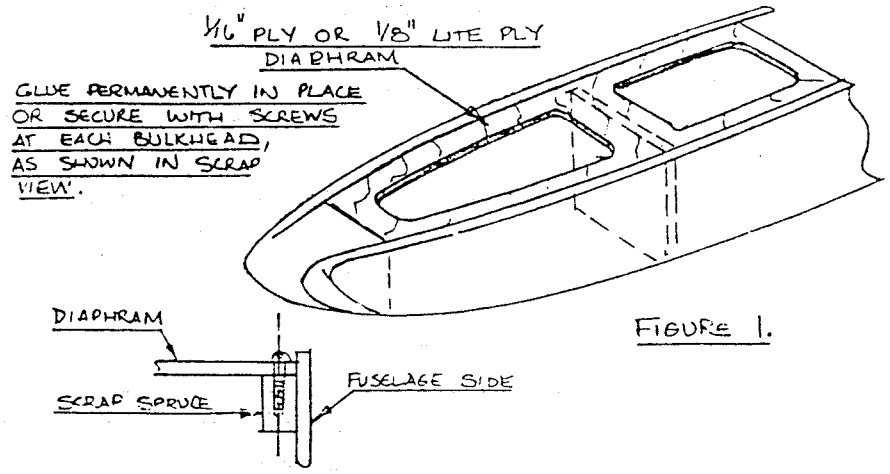
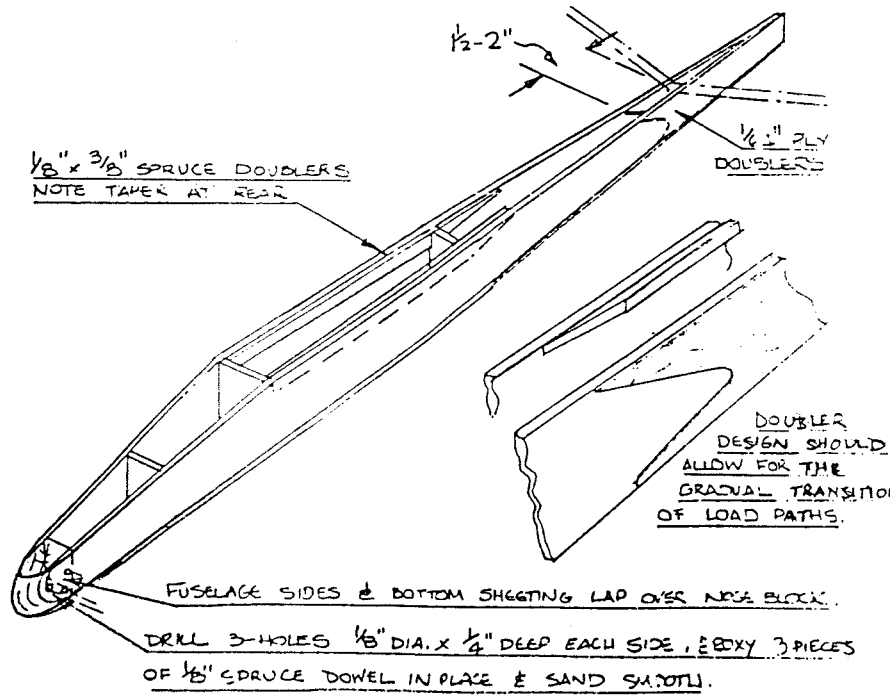
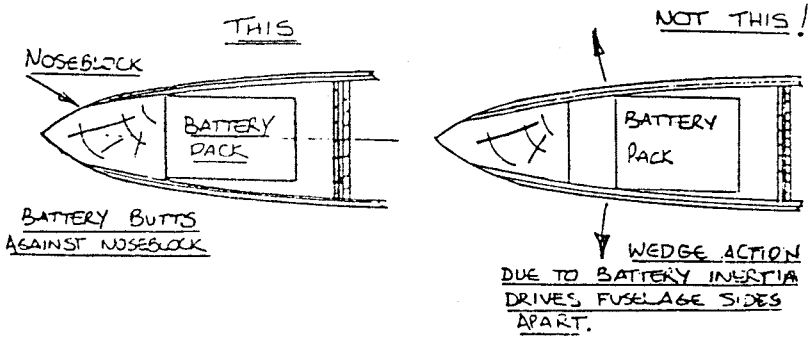


FIGURE 1.

A considerable gain in fuselage rigidity can be made by adding a plywood diaphram over the radio equipment bays, as shown in Figure 1. This can be glued in place after the servos are installed, or if you want to retain good access to the servos, the ply can be held in place with selftapping screws as shown in the detail figure. These should be at least six screws and they should be positioned midway between the fuselage formers. The diaphram can also be mounted further down inside the fuselage where it becomes a servo tray as well as a fuselage stiffener. In the case of the Sagitta, where there is very little excess space around the servos, the forward radio hatch can be made to take some of the landing loads and therefore stiffen the forward fuselage. If the balsa fairing is mounted on a plywood base which is attached to the forward fuselage with screws as described for the ply diaphram, it will absorb some of the vertical and side landing loads and prevent the lozenging and bulging actions I've described.

A further option is to make the servos themselves structural members. The reliability of modern servos has led to the handlaunch brigade building them into their fuselages. There's no reason not to adopt this practice for the competition sailplane. The elevator and rudder servos can be sandwiched between balsa blocks, and the whole assembly sanded to the contour of the fuselage sides and epoxied in place. This will dramatically increase the resistance of the forward fuselage to lozenging.





The stiffness of any rectangularsection structural member is equal to the depth of the section cubed. For the rectangular and I-section beams shown in Figure 2., the moment of inertia (I) is

$\frac{bd^3}{12}$ for the rectangular beam, and $\frac{b(D^3 - d^3)}{}$ for the I-beam section.

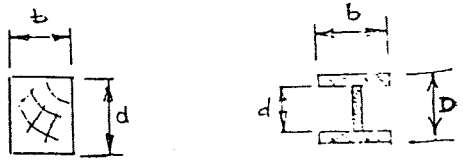


FIGURE 2.

In the case of the I-beam, for example, if we double the distance between the spar caps, for the same maximum stress in the caps the beam will be able to withstand eight times the bending load. Relating this to the forward fuselage sides, landing shock loads can be resisted by the classic method of adding spruce doublers to the upper edge of the fuselage as shown in Figure 3. In the case of the Sagitta, where the shrink-tube fit of the fuselage around the servos leaves insufficient space for spruce doublers, I would recommend adding carbon fiber doublers, as shown in the sketch. As an experiment, split off a piece of carbon-fiber sheet 0.007 inches thick and about 1/4-inch wide. Cut it into two short strips and Hot-Stuff them together. What you have is a highly flexible carbon-fiber spring. Now take two similar carbon-fiber strips and Hot-Stuff them to the softest piece of 1/4-inch square balsa in your scrap box. What you now have is a structural beam that cannot be broken with your bare hands! You have increased the 'd' diminsion of the carbon-fiber by about 10 times, and the stiffness by 10 cubed ... 1000 times.

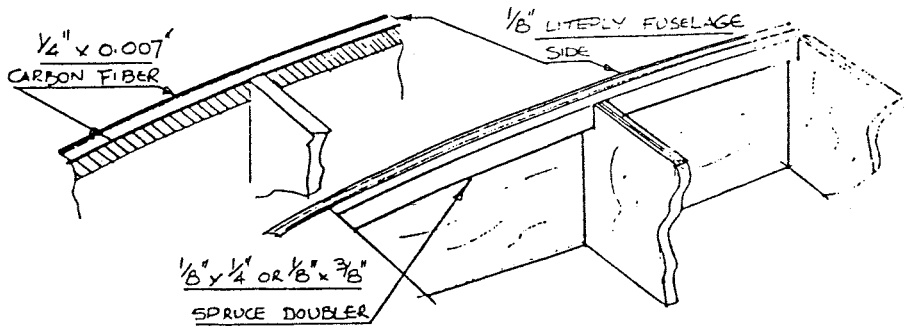


FIGURE 3.

ALLURE...A REPORT OF MY EXPERIENCE.....TYSON D. SAWYER

"AFTER DOING SOME EXPERIMENTING WITH A NEW SAILPLANE, I CAME UP WITH A FEW WING 'TIPS' (AND TURBULATORS) THAT MIGHT BE OF INTEREST TO RCSD READERS.

"HAVING ALMOST COMPLETED MY NEW BALSA USA SAILPLANE (COMPLETED ENOUGH, THAT IS, TO FLY) I WENT OUT AND MADE SOME HAND LAUNCHES. THE AILERONS HAD NO EFFECT, SO I INCREASED THE THROW, AND FINALLY JUDGED IT GOOD ENOUGH TO PUT IT UP ON THE HI START. BY THE TIME I GOT A CHANCE TO TRY IT ON THE HI START, THE WINDS WERE 10 - 15 KNOTS AND GUSTING HIGHER (NOT EXACTLY TEST-FLYING WEATHER) BUT I JUST COULD NOT WAIT. IN ABOUT 15 MINUTES I FOUND MYSELF HOLDING A NEW GLIDER HOOKED TO THE END OF A STRETCHED-OUT HI START AND 20 KNOTS OF WIND GUSTING IN MY FACE. I HAD A COUPLE OF SECOND THOUGHTS, DROPPED A FEW DEGREES OF FLAPS (NOT INCLUDED IN THE PLANS...BUT I ADDED THEM FOR GLIDE-PATH CONTROL) AND THREW THE PLANE INTO THE AIR. IT WAS A FLIGHT THAT TURNED OUT TO PROVIDE THE PILOT WITH EXCELLENT CARDIO-VASCULAR EXERCIZE!

"THE FLIGHT BEGAN WITH A SHARP HOOK TO THE RIGHT, FOLLOWED BY A SWERVING CLIMB-OUT AND A STALL AT THE TOP OF THE LAUNCH. AFTER RECOVERING FROM THE STALL, I TURNED DOWN WIND AND IMMEDIATELY SAW THAT I WOULD NOT HAVE MUCH TIME TO PLAY AROUND, SO I SET UP A LANDING PATTERN THAT WOULD LEAVE PLENTY OF ROOM FOR ERROR. TRYING TO GET A BIT OF A 'FEEL' FOR THE GLIDER, I SLOWED IT UP A LITTLE BIT, ONLY TO FIND THAT BELOW ABOUT 15 KNOTS IT FELL LIKE A ROCK AND HAD NO ROLL RESPONSE. A COUPLE OF TIMES THE TURBULENCE TOSSED ME UP ON ONE WING, AND I WAS UNABLE TO ROLL LEVEL UNTIL THE NOSE WAS WELL DOWN. ALL TURNS STARTED WITH FULL AILERON, AND THEN I HAD TO WORK IT AROUND WITH RUDDER. THE APPROACH WAS MADE WITH FULL FLAPS AND THE NOSE WELL DOWN TO MAINTAIN FLYING AND CONTROL SPEED. AFTER MY HEART RECOVERED, I DECIDED TO TRY ANOTHER LAUNCH TO SEE IF I COULD GET A BETTER IDEA OF WHAT MIGHT BE WRONG. THE SECOND FLIGHT WAS ALMOST IDENTICAL TO THE FIRST.

"AFTER SWEARING AT THE GLIDER (I DON'T THINK IT WAS LISTENING) I CALLED JIM TO GIVE HIM AN UPDATE ON THE TEST FLIGHTS. AFTER SOME TALK, HE SUGGESTED THAT THE PROBLEM MIGHT BE LAMINAR SEPARATION ON THE TOP OF THE WING, WHICH WOULD POSSIBLY ACCOUNT FOR THE POOR GLIDE PATH AND POOR AILERON RESPONSE. (WITHOUT THE AIR FLOWING OVER THEM, THEY WOULD NOT HAVE MUCH EFFECT). SO, WE DECIDED TO PUT SOME TURBULATOR STRIPS ON THE WING.

"HERE'S THE SITUATION AS WE ANALYZED IT: LAMINAR AIRFLOW (SMOOTH AND WITHOUT TURBULENCE) CAUSES THE LEAST DRAG BECAUSE THERE IS LITTLE ENERGY TRANSFER BETWEEN THE LAYERS OF AIR AND THE WING SURFACE. HOWEVER, LAMINAR FLOW HAS A GREATER TENDENCY TO SEPARATE FROM THE SURFACE OF THE WING AT HIGHER ANGLES OF ATTACK...CAUSING A BIG INCREASE IN DRAG AND A REDUCTION IN LIFT. ON THE OTHER HAND, TURBULENT FLOW CAUSES GREATER ENERGY TRANSFER BETWEEN THE LAYERS OF AIR (AND THEREFORE SLIGHTLY HIGHER DRAG) BUT IT ISN'T AS APT TO SEPARATE FROM THE WING AND CREATE THE PROBLEMS WE OBSERVED (HIGH DRAG AND LOSS OF LIFT, TOGETHER WITH POOR AILERON RESPONSE). ARTIFICIAL TURBULATION CAN BE PRODUCED BY MEANS OF A TURBULATOR STRIP, TO INDUCE EARLY TRANSITION FROM LAMINAR TO TURBULENT FLOW. IN THIS CASE, I USED THREE LAYERS OF 1/16" WIDE BLACK STRIPING TAPE PLACED ABOUT 1/10TH CHORD BACK FROM THE LEADING EDGE OF THE WING.

ALLURE (CONTINUED).....SAWYER

"A FEW TEST FLIGHTS SHOWED A BIG IMPROVEMENT IN CONTROL RESPONSE AND IN THE GLIDE PATH. MOVING THE TURBULATOR TO THE 20 - 25% POSITION ON THE WING SHOWED STILL FURTHER IMPROVEMENT IN PERFORMANCE, BUT IT STILL HOOKED TO THE RIGHT ON LAUNCH AND STILL DISPLAYED THE SHARP TIP STALL ON THE RIGHT WING.

"AT THIS POINT I MUST CONFESS THAT I'M NOT A VERY GOOD BUILDER, AND HAD ENDED UP WITH SOME PRETTY BAD COVERING WRINKLES ON THE LEADING EDGE OF THE WING.. DECIDING THAT THE WRINKLES COULD BE CONTRIBUTING TO THE SHARP STALL CHARACTERISTICS, I PLACED SOME WIDE ELECTRICIAN'S TAPE ON THE LEADING EDGE TO SMOOTH IT UP...AND DISCOVERED THAT THE STALL BECAME A BIT MORE GENTLE, BUT WAS STILL THERE, AS WAS THE HOOK TO THE RIGHT ON LAUNCH. LAUNCHES CONTINUED TO BE A BATTLE BETWEEN THE SHARP TIP STALL AND THE PILOT'S REFLEXES (JIM EVEN STALLED AND SPUN THREE TIMES WHILE STILL HOOKED ON...WITH A LARGE CROWD WATCHING!). OUR NEXT IDEA WAS THAT MAYBE THE PRESENCE OF AILERONS GOING ALL THE WAY OUT TO THE TIPS AND ACTUALLY FORMING A PART OF THE TIPS, WAS CAUSING INTERFERENCE WITH THE TIP VORTEXES AND SOMEHOW CREATING THE PROBLEM. JIM SUGGESTED THAT I PUT SOME TIP PLATES ON THE ENDS OF THE WING TO IMPEDE AIRFLOW AROUND THE END OF THE TIPS...SO I TOOK MY RAZOR SAW AND PAINFULLY REMOVED THE TIPS. I CUT OUT THE TIP PLATES FROM 1/16" PLYWOOD AND MADE THEM BIGGER THAN THE TIP AIRFOIL ALL THE WAY AROUND THE END RIB, ZAPPING THEM INTO PLACE. UGLY! THEY LOOKED SOMETHING LIKE SKIDS AND SOMETHING LIKE A MAD INVENTOR'S NIGHTMARE.

"WHEW! WHAT A WORLD OF IMPROVEMENT ON THE CONTROL END OF THINGS! THE TEST LAUNCH WITH THE NEW TIP PLATES STARTED WITH A SHARP RIGHT (OHH...THAT DAMNED RIGHT HOOK!) THAT COULDN'T HAVE BEEN RECOVERED FROM WITH THE OLD CONFIGURATION. I'M NOT CLAIMING THAT THE TIP PLATES ARE THE BEST SOLUTION TO THE PROBLEM, AND I SUSPECT THAT ANY TIP THAT KEEPS THE AILERONS OUT OF THE VORTICES WOULD WORK FINE.

"AT THIS POINT WE HAD GONE FROM A FAST AND BARELY CONTROLLABLE LAUNCH WITH A WIDE, FAST PATTERN, AND LANDING, TO A DESIGN THAT FLEW VERY WELL WITH GOOD CONTROL. (IT EVEN DID NICE TURNS WITHOUT ANY RUDDER!). THE ALLURE HAD BECOME A COMPLETELY DIFFERENT MACHINE, EXCEPT FOR THAT RIGHT HOOK.

"JIM SUGGESTED TO ME THAT THE WING MIGHT HAVE WARPED ENOUGH DURING THE CONSTRUCTION AND MODIFICATION PHASE TO ACTUALLY HAVE WASH-IN RATHER THAN THE DESIRED WASH-OUT OR, AT VERY LEAST, NEUTRAL TWIST. JIM (WHO HAS BEEN INCREDIBLY BUSY LATELY) FINALLY FOUND SOME TIME TO COME FLY WITH ME. SURE ENOUGH, THERE WAS SOME WASH-IN IN THE RIGHT WING, SO I RETWISTED THE WING UNDER HEAT AND MANAGED TO GET BOTH WINGS RIGHT. THE WIND WAS BLOWING AT ABOUT 20 KNOTS AGAIN, AND JIM DIDN'T DARE PUT UP HIS GENTLE LADY. HOWEVER, THE ALLURE WITH ITS 10.5 OUNCE-PER-SQUARE FOOT WING LOADING DIDN'T MIND THE WIND AT ALL. BELIEVE IT OR NOT, THIS WAS THE SAME ALLURE THAT I WOULD HAVE GLADLY STOMPED INTO THE GROUND AFTER THAT FIRST FLIGHT! IT FLEW LIKE A CHAMP: FAST, SMOOTH, EASILY CONTROLLED, AND A NICE FLAT GLIDE WITH EXCELLENT PENETRATION.

"LUCK WASN'T ENTIRELY WITH US THAT DAY, HOWEVER, IN SPITE OF ALL THE WORK WE'D DONE TO IMPROVE THE SAILPLANE. ON ONE OF THE LAUNCHES, SHE MET DISASTER. AT ABOUT 70 FEET ON A LAUNCH THE VEE TAIL SEPARATED COMPLETELY FROM THE REAR FUSELAGE AND WENT ON ITS OWN WAY. AFTER SOME

SAWYER CONTINUES...

SURPRISINGLY STABLE FLIGHT INVERTED (I HAD PUT THE FLAPS DOWN FOR LAUNCH, MAKING THE AIRFOIL LOOK LIKE A REFLEXED, OR FLYING WING AIRFOIL WHEN INVERTED) FLIGHT, SHE SPUN IN FROM ABOUT 30 FEET - STILL ATTACHED TO THE HI START WHICH WAS PULLING LIKE CRAZY - AND SMASHED INTO THE ONLY 10-FOOT SECTION OF PAVEMENT IN THE ENTIRE FLIGHT PATH! LADY LUCK WAS ON A TEN-MINUTE BREAK, I GUESS. SO WE LOST THE LITTLE GLIDER (FUSELAGE DEMOLISHED, WING SALVAGEABLE WITH ONLY SLIGHT DAMAGE, AND THE VEE TAIL INTACT) BUT WE LEARNED SOMETHING ABOUT AERODYNAMICS, STABILITY AND CONTROL...AND HOW TO GET AN APPARENTLY HOPELESSLY-BUILT GLIDER TO FLY LIKE A CHAMP.

"I DON'T WANT THIS LETTER TO SCARE ANYONE FROM BUILDING AN ALLURE, WHICH I BELIEVE IS A GREAT SAILPLANE. THE VEE TAIL SHOWED ABSOLUTELY NO BAD HABITS, AND I AM CONSIDERING BUILDING ANOTHER FUSELAGE FOR THE ORIGINAL WING AND TAIL. BEFORE THE TAIL FELL OFF (DUE TO A POOR GLUE JOINT - REMEMBER, I SAID I WASN'T MUCH OF A BUILDER) THE SHIP FLEW GREAT, AND I SUPECT THAT ANY PROBLEMS WE ENCOUNTERED WERE A PRODUCT OF MY INEPT BUILDING RATHER THAN ANY INHERENT DESIGN FLAWS.

COMMENT:

TY IS VERY MODEST. HE IS A 'NATURAL' PILOT, AND A PRETTY DECENT BUILDER, CONSIDERING THAT HE'S ONLY BUILT ABOUT THREE PLANES IN HIS LIFE! HE'S A LEVEL II ALREADY, AND NEEDS ONLY A FEW MORE POINTS FOR HIS LSF LEVEL III. HE IS VERY MUCH 'INTO' DESIGNING SAILPLANES AND HAS ALREADY DESIGNED A CANARD SAILPLANE WHICH IS NOW UNDER CONSTRUCTION. HE ENJOYS COMPUTERS AND HAS COMMITTED SOME DESIGN PROGRAMS TO DISK TO HELP HIM WITH THE MORE ESOTERIC ASPECTS OF CAD FOR SAILPLANES. YOU WILL MEET HIM AT THE NATS THIS YEAR, FLYING IN THE 100" AND TWO-METER CLASSES. BY THE WAY, TY IS ONLY FIFTEEN YEARS OLD!

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NEWS AND VIEWS

IN CASE YOU DON'T ALREADY KNOW, JERRY SLATES OF VIKING MODELS USA HAS BOUGHT OUT HI JOHNSON MODEL PRODUCTS, AND WILL BE FURNISHING THAT COMPLETE LINE OF GOODIES FORMERLY PRODUCED BY HI - AND ULTIMATELY MIDGE - JOHNSON. LOOK FOR JERRY'S AD IN RCSD.

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HAVE YOU TRIED LARRY SRIBNICK'S "SR" BATTERIES YET FOR YOUR SAILPLANE? IF NOT, YOU'D BETTER GET SOME FOR YOUR RECEIVER AND TRANSMITTER, AND A COUPLE OF SPARES. THESE ARE THE BEST BATTERIES AVAILABLE ANYWHERE, AND HAVE ULTRA-LONG LIFE FOR THEIR SIZE DUE TO LARRY'S SPECIAL PROCESS AND MATERIAL OF MANUFACTURE. THEY COME IN THE USUAL FLAT PACK, SQUARE PACK, SHAPES AS WELL AS SOME NEW AND DIFFERENT ONES THAT COULD BE A BIG HELP TO YOU. WRITE TO LARRY AT: SR BATTERIES, INC., BOX 287 BELLPORT, NY 11713. I WOULDN'T BE MAD IF YOU MENTIONED RCSD, EITHER.

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REMEMBER CLARK SMILEY'S DOPE-AND-FIBERGLASS FINISHING METHOD? WELL, HE'S GOT ANOTHER IDEA FOR US: USE THE INNER PART OF YOUR NYLON CONTROL ROD TO CARRY A STILL SMALLER CABLE OR CONTROL WIRE. IT IS LOW-FRICTION, AND ALMOST ZERO SLOP. BY THE WAY, BE SURE TO CEMENT THE OUTER PART CAREFULLY ALONG ITS RUN, AND THEN CEMENT THE INNER PART AS WELL TO SECURE IT. MAKE SURE THE RUNS ARE AS STRAIGHT AS POSSIBLE, TOO.

*****

TESTING OF NICAD BATTERY CAPACITY by Lee Murray

There are many devices to test the capacity of the batteries that you are using and more than enough terms to confuse most any modeler. Fortunately there is an inexpensive and simple method of testing of NiCad batteries that I will describe and will require a minimal outlay of those precious "hobby bucks". The reason why you want to test your batteries include:

1. The capacity of NiCad batteries decreases with time and with the number of charge-discharge cycles.
2. NiCad batteries are subject to failures which may suddenly change the voltage and capactiy of the battery pack.
3. NiCad batteries develop a "memory" effect that will limit the capacity of the batteries to the level of discharge that they normally experience between charges[1].

Experienced users of NiCad batteries routinely replace a battery pack whenever the battery capacity decreases to 50% of the new battery capacity specification or after a given period of time based on experience (five years for example). The batteries can be damaged due to crashes or other kinds of abuse such as improper charging or discharging conditions. Chemical reactions occuring during overcharging and at elevated temperatures reduce the performance of batteries. Fortunately the memory effect referred to previously is correctable provided that the battery pack is deep cycled a few times.

In order to provide the best treatment for your NiCads manufacturers recommend that you use low charging rates for overnight charging. To accomplish this I use a light timer to disconnect the charger after the 16 hours for the normal recharging or 20 hours for a charge after a total discharge using 50 milli-amp (MA) charger. A simple modification to a light timer will limit the charging to one cycle even though you don't remember you were charging your batteries for a week or more. The modification to the circuit is shown in figure 1. Batteries smaller than 500 MA will require a charge rate lower than 50 MA roughly equal to 1/10 the stated capacity. I use a 50 ohm resistor with a Futaba charger to charge 175 MA batteries at a 30 MA rate. A 1200 MA pack is charged at a 50 MA rate provided by the standard charger but for two 16 hour periods. One way to protect your batteries from overcharging damage and stil be able to charge your batteries at a higher rate is to purchase a dual rate charger which will automatically change to a low charging rate when the voltage of the battery increases near the end of its charging cycle.

A simple method for measuring the battery capacity involves using a 10 watt 20 ohm resistor (actually two 10 ohn resistors in series[2]). The batteries are connected to the resistor using the standard charge cord which is plugged into a connector which is wired to the resistors, see figures 2 and 3. The resistors will get warm so be carefull not to touch them during a capacity check, especially during a check of your transmitter pack. I begin to make voltage measurements with a volt-ohm meter and/or expanded volt meter and continue to make measurements every 5 to 10 minutes until the battery is discharged. The voltages are logged with the times of the measurements for later plotting. When the voltage of a 4 cell pack reaches 4.2 volts the resistor is disconnected and the calculations are made. A plot of a typical discharge curve is shown in figure 4.

The capacity of batteries is calculated from the equation:

CAPACITY = Discharge rate * hours to discharge battery

This equation can be expressed in the units you will be using for 4 and 8 cell packs.

CAPACITY =(4.8 v/20 ohms)*(minutes to discharge/60 min/hr)*1000 MA/A
=4 * minutes to discharge (for a 4 cell battery)
=8 * minutes to discharge (for an 8 cell battery)

An effective volt-ohm meter is one with a 5 and 10 volt range. Radio Shack has a meter for about $25 on sale and is the source of the measurements reported in the attachment. The purchase of an expanded scale volt meter (ESV) is very valuable for field measurements of battery charge. ESVs measure a portion of a scale, e.g. 4 to 5 volts. There are a few which can be purchased for about $15. When purchasing one of these low cost ESVs it is recommended that you compare the readings with those of another meter and make any adjustments that may be needed. Another method of checking the ESV is to test the capacity of a good NiCad pack using the procedure described. I should add that in order for an ESV or any other meter to make a good evaluation of battery charge there should be a load resistor used to place a load on the batteries. If the ESV you use doesn't have a load resistor you can use the 20 ohm resistor described previously.

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1. James Doe, "Secondary Batteries", Encyclopedia of Chemical Technology
2. Available from Radio Shack

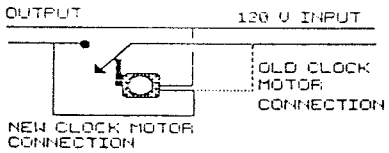

Figure 1
Light Timer Modification

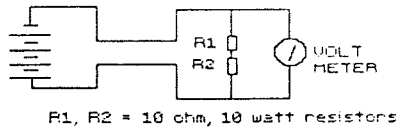

Figure 2
Discharging Circuit

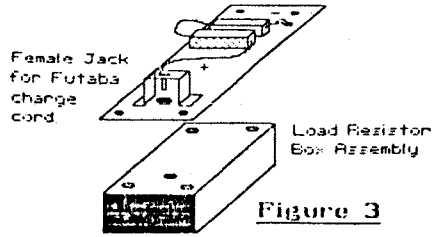

Figure 3

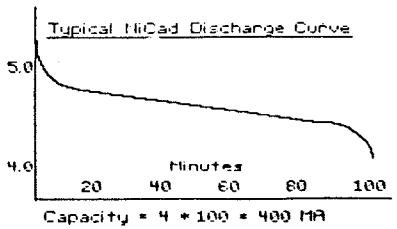

Figure 4

AIR MAIL...STEPHEN O'LEARY COMMENT'S ON CHERNOFF'S ARTICLE...

"I FOUND MAX CHERNOFF'S ARTICLE VERY INTERESTING. IT IS A PLEASURE TO READ AN ARTICLE BY AN 'EXPERT' AND FIND THAT THE AUTHOR REALLY DOES KNOW WHAT HE'S TALKING ABOUT. ALTHOUGH I AGREE WITH EVERYTHING MAX STATED IN THE ARTICLE, I WOULD LIKE TO ADD SOME CLARIFICATIONS THAT MIGHT PREVENT SOME READERS FROM DRAWING IMPROPER CONCLUSIONS. I DO NOT CONSIDER MYSELF AS MUCH OF AN EXPERT AS MAX, AND IF HE DISAGREES WITH ANYTHING I SAY, DON'T PUBLISH IT. (YOU WON'T GET OFF THAT EASY, STEVE...JHG).

"READERS SHOULD REMEMBER THAT HE WAS DISUSSING PROBLEMS OF HIGH-SPEED FLIGHT, CONDITIONS THAT DO NOT NORMALLY APPLY TO THERMAL FLYING. IT IS TRUE THAT IF THE CENTER OF PRESSURE IS BEHIND THE SHEAR CENTER THE WING WILL NOT SUFFER FROM DIVERGENCE. IF THAT IS NOT THE CASE, DIVERGENCE CAN OCCUR, BUT THE SPEED AT WHICH IT WILL OCCUR DEPENDS ON THE TORSIONAL AND BENDING STIFFNESS OF THE WING. THE STIFFER THE WING, THE HIGHER THE SPEED AT WHICH FLUTTER WILL OCCUR. IT IS POSSIBLE TO MAKE A MODEL WING SO STIFF THAT IT WILL NOT FLUTTER AT SPEEDS ACTUALLY ENCOUNTERED. THIS BRINGS ME TO THE MAIN REASON FOR WRITING: I DESIGN MY OWN WING STRUCTURES AND ALWAYS USE TWO SPARS. THIS CONFIGURATION WHEN ENCLOSED WITH WING SHEETING AND COMBINED WITH A D-TUBE, IS EXTREMELY STIFF IN BENDING AND TORSION. THIS COMPENSATES FOR THE REARWARD MOVEMENT OF THE SHEAR CENTER. I USE THE TWO SPAR APPROACH BECAUSE I CAN MAKE THE WING VERY STRONG IN THE CENTER, AND I CAN EASILY REDUCE THE SPAR STRUCTURE IN ACCORDANCE WITH THE WING LOADS AS IT EXTENDS TOWARD THE WING TIPS. SPARS AT 15% AND 35% OF CHORD, FOR EXAMPLE, WILL STILL HAVE A SHEAR CENTER AT THE QUARTER-CHORD POINT. EVEN IN DIVES FROM HIGH ALTITUDE I HAVE NEVER HAD A FLUTTER PROBLEM..

"TO SUMMARIZE, THE WING STRUCTURE HAS TO BE DESIGNED FOR THE INTENDED USE OF THE GLIDER, AND WHAT IS GOOD FOR AN FAI-F3B MODEL IS NOT NECESSARILY BEST FOR ANY OTHER TYPE OF GLIDER.

"THE ARTICLES THAT I ENJOY MOST IN RCSD ARE THOSE THAT TEND TO BE TECHNICAL AND THOSE THAT GIVE SPECIFIC DETAILS ABOUT GLIDER DESIGNS; ACTUAL AND THEORETICAL INFORMATION ABOUT AIRFOILS; BUILDING MATERIALS; AND AERODYNAMICS; ARE MOST INTERESTING. I AM ALSO INTERESTED IN TECHNICAL INFORMATION ABOUT FLYING WING GLIDERS (I LIKE A CHALLENGE). I HAVE THE TWO WHITE SHEET EDITIONS ABOUT FLYING WINGS, AND WILL BE BUILDING MY FIRST WITHIN A YEAR. I'LL LET YOU KNOW HOW IT TURNS OUT."

YOURS TRULY, STEPHEN H. O'LEARY

COMMENTS: THANKS FOR THE INPUT, STEVE. I THINK MAX WAS TRYING TO MAKE THE POINT THAT FLUTTER PER SE DOES NOT USUALLY OCCUR ON MODELS, AND THAT WHAT WE TEND TO CALL FLUTTER IS, IN FACT, NOT FLUTTER. I DID SEE A CASE OF AILERON FLUTTER, AND I DID SEE A CASE OF ELEVATOR FLUTTER ON A COUPLE OF MODELS (DIFFERENT ONES, THANK GOODNESS) AND IT WAS A DESTRUCTIVE VIBRATION WHOSE MAGNITUDE BUILT UP UNTIL STRUCTURAL FAILURE OCCURRED. IN THIS SENSE, PERHAPS I - TOO - DISAGREE WITH MAX, BUT LET'S GET A GOOD DISCUSSION GOING HERE SO THAT WE MAY ALL LEARN SOMETHING. BY THE WAY, SEE MAX' LATEST ARTICLE IN THIS ISSUE ABOUT CONTROL SURFACE DEFLECTION. HE'S GOT A COUPLE MORE ON THE WAY, TOO. IT'S GOING TO BE FUN AND PERHAPS EVEN A BIT CONTROVERSIAL BEFORE WE'RE THROUGH...JIM.