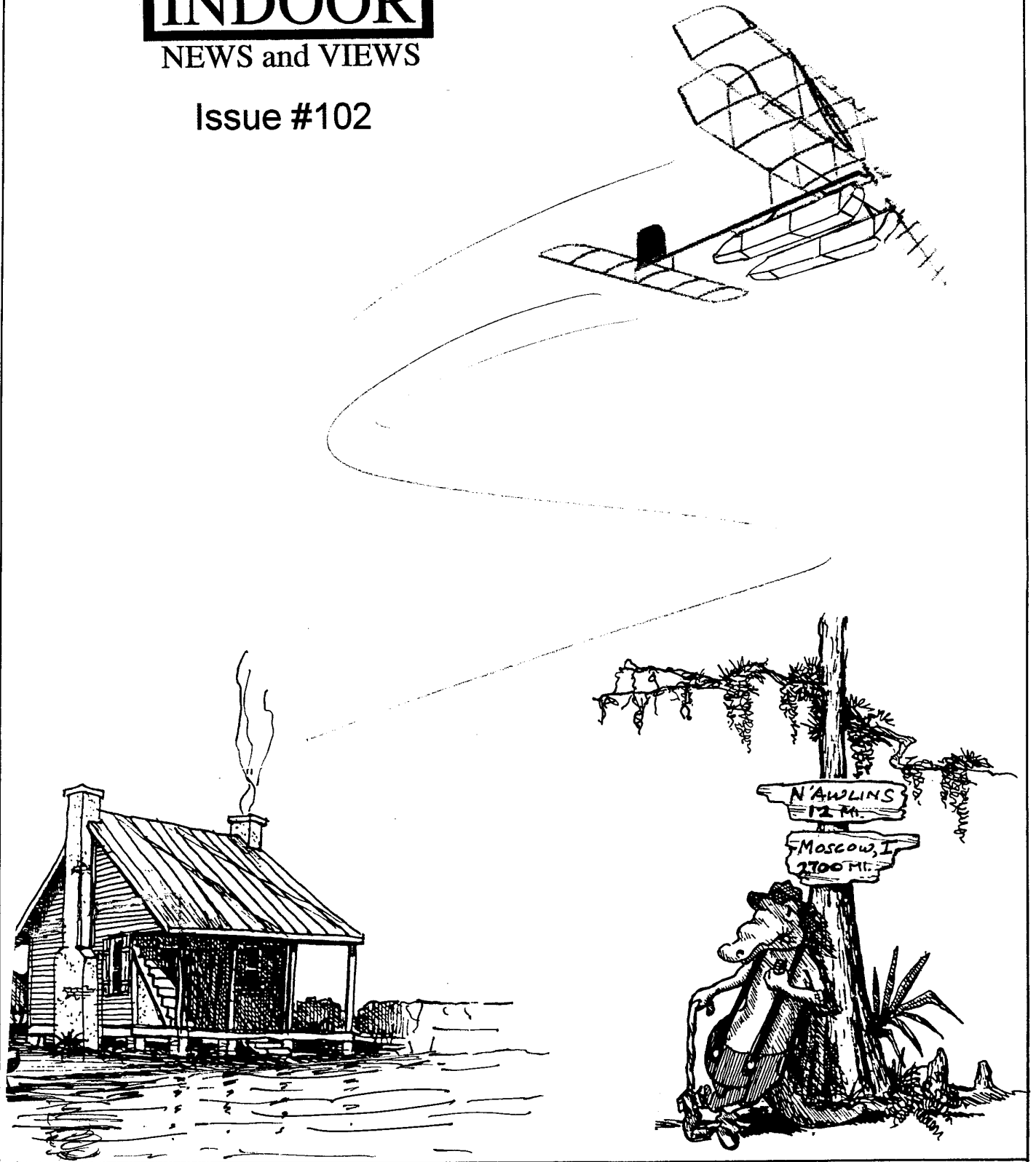


INDOOR

NEWS and VIEWS

Issue #102



Indoor News and Views has Moved!

With INAV Issue #102 we begin publication from that famous jewel of the South, New Orleans, Louisiana (pronounced 'Nawlins, down here, mon Cher). You may be thinking of backwater bayous and crawfish and Carnival, but it was Big Oil that brought me down here in 1982, and it is still a pretty big industry. We have some prime indoor spaces, too; covered football and hockey fields such as the Louisiana Superdome, and the new Sports Arena. We hope to arrange for the use of these in the future. We also hope to build on Steve Gardner's use of digital techniques in laying out the magazine, and most of what you see in the following pages is a reflection of that. I would like to thank all the contributors who just about wrote this issue for us, Tim Goldstein for getting the word out, Steve for a great format which we will continue to use, and all of those at U.S.I.C. who gave their well wishes for the future.

- Carl Bakay

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Unless specifically stated, INAV does not endorse any products or services advertised herein. Sample ad copy should be sent to Tim Goldstein at the above address for publishing details.

Coming in issue 103 due out in August

- USIC Results
- Built up prop construction by Steve Brown
- Steering by John Kagan

From the Membership Desk

Tim Goldstein (see inside front cover for contact information)

Exciting things have been happening with Indoor News and Views since the last issue and a few changes have been made. Great feedback has been provided by you INAV members and Carl and I have been working hard to help INAV get greater exposure.

First the changes:

INAV subscriptions rates have been increased. Details are on the inner cover. With the greater frequency we are planning and the increased postage rates this was unavoidable. Any renewals or new subscriptions since May are at the new rates. Expiration dates for paid up subscribers will not change, but any new subscriptions or renewals since May are being adjusted to the new rate.

Discounted Junior subscriptions:

We are implementing a new subsidized subscription for juniors to help them learn about the sport and expose them to the great range of activities indoor flying covers. Details are on the inner front cover. We have already signed up a number of Juniors who are finding INAV to be an invaluable resource.

Back issue price increase:

Back issues are being increased from \$3.00 to \$4.00 per issue plus postage. While we know that back issues are very valuable to new people entering the sport the cost and trouble to make them available is very high. The new rate still does not totally cover all that it takes, but will help us to continue offering this service. We are now able to provide any issue from January 62 to current as a back issue. If you need more than 1 or 2 issues I would suggest you consider the Archive and then print them yourself at a far lower cost.

Announcements:

INAV Archive on CD:

Indoor News and Views announces the release of an Archive CD containing the complete issues from Jan. 1962 to current. The archive comes with a custom written viewer program. The program is only for PC computers running Windows 95, 98, ME, 2000, or NT 4. Recommended minimum is a 350 Mhz system, but it will work on any Pentium class computer. The viewer program lets you look up issues by publication date, print any page of an issue, build an index, search by your index, and just plain view the issues. All articles, plans, tips, photos, drawings from over 250 issues are included. This is a great way to have all the tremendous information from INAV at your finger tips. Cost is only US\$45.00 plus shipping (\$3 USA, \$5 all others) which works out to less than 0.18 cents per issue. Proceeds from the sale of the Archive CD will be used to promote Junior flying and is already subsidizing the Jr subscriptions.

Subscription expiration:

Everyone has been great on getting themselves caught up on their subscription and we appreciate it greatly. I will be marking the expiration date on your mailing label with a highlighter if you have reached the point that this will be your last issue. Please check your label just incase I missed marking any. Starting with the next issue we will be mailing only to subscribers that are current and missed issues will have to be purchased as back issues.

General:

Our new editor Carl Bakay has been on a campaign to promote awareness of INAV. He has been sending subscription forms and sample issues to clubs and set up a booth at USIC demonstrating the Archive CD and promoting the newsletter. First, I think we all need to thank Carl for the initiative he is displaying to help this newsletter. Second, based on his feedback I am amazed at the number of people that are flying indoor and don't even know that INAV exists. You can help the sport and the newsletter by telling anyone with even a remote interest in indoor flying about INAV and suggesting they subscribe. I attended the Science Olympiad Nationals and worked as a volunteer. I handed out over 50 promotional copies of INAV to the SO fliers. They were excited to learn that a source of information on indoor flying exists. Had some of the fliers take advantage of the new Jr subscription rate and had a great time.

I am planning on attending Kibbie Dome in July and hope that you will all wander down to the light weight area and say hello.



S.O. Wright Stuff INTRODUCTORY ARTICLE

Indoor News and Views will begin to present news from Science Olympiad and other school freeflight activities to compliment the growing trends in education. The last five years have been exciting as both individual schools as well as national education competitions have accepted freeflight as a bonified learning tool. The most visible activity has been occurring in the Science Olympiad community and this column will key on those events. We also want to give coverage to other schools or school organizations in hopes of spreading the freeflight phenomena. Feel free to contact the editors if you have experienced kids learning with freeflight or if you have something to teach these students.

My current experience not only includes Science Olympiad's Wright Stuff Events but also the Technology Student Association's (TSA), EAA's Wild Blue Wonders™ and Civil Air Patrol's (CAP) education initiative which are all promoting miniature flight (freeflight) as part of their curriculum. All four-education programs offer an opportunity to connect freeflight with the general population. By no means are any of these a "magic bullet" to eliminate the "youth problem". In reality, most young people are simply overwhelmed with too many activities and entertainment options to maintain a dedicated commitment to the more sophisticated activities. We, as the freeflight community, will eventually see a gradual increase in enthusiasts over the next few years. The substantial increase will happen after ten years when today's youth flying in these competitions will have started their own families and are financially secure. It will be then that the majority of these former students will sentimentally reflect on what thrilled them in their youth and once again become enamored with the freeflight legacy.

In the mean time, we should commit to priming the freeflight pumps to nurture the few gifted novices out there today, since those few who will be the inspirations for the future enthusiasts to follow.

With these thoughts in mind, I chose for the first installment to focus on Science Olympiad mentors. Hopefully, you will recognize many of these people as strong AMA competitors who have become involved with the "SO kids".

We can begin in the northeastern states and swing our way around to the southwest.

In Connecticut, those flyers congregating at the MIT indoor site have been quite generous with the local SO teams. Ray Harlan from the AMA Indoor Board has been very productive in the providing kits and other support to many SO teams. In New York there is Bob Clemens who not only coaches teams but also runs the NY State Wright Stuff Competition. Bob puts out an excellent resource on the internet that can be found at <<http://www.scaleaero.com/ffvendors.htm>>. Don Ross is pitching whenever he can in **FLYING MODELS** and at the local flying sites including the new Armory site.

Moving down to the tri-state area near Philadelphia, both the members of Scale Old Timers Society (SOTS) and the East Coast Indoor Modelers (ECIM) have had positive impact on local teams. By far the most active is Joe Krush whom, it is rumored, has coached over seven teams ranging as far south as the bottom of Delaware. Joe's been flying since the middle 30's so that's quite an achievement. Incidentally, Joe and the SOTS still put on indoor airshows at local middle schools whenever they can.

In Maryland, D.C. and Virginia there is activity covered by Tom Valee, the DC Maxcuters and the ever-industrious Brainbusters. Note that the Abraham Van Dover and the Brainbusters assisted at TSA NATS in DC a few years ago and coaches still come up to give a compliment on their fine job of officiating.

Reaching the Georgia Peach State it seems every freeflyer in the Thermal Thumbers has been a mentor. Dohrm Crawford, Gary Baughman, Dave Zeigler, George Perryman and many, many others have all supported the winning efforts coming out of Georgia. A gaggle of teams are expected to come to USIC for the special SO events in June.

In Tennessee, Neal Henderson, has coached at least four teams and happened to coach some of the winning teams at SO NATS last year. This year Neal was arranging to have some of these team members compete at USIC.

Here in the Midwest we can start near Cleveland where Doc Hacker, Don Slusarczyk and the Cleveland Clowns have the most progressive programs for the local SO Teams. The recent news is that their protégé's are now knocking down AMA junior records. More details on these record breakers will be covered in the future. There will be a few strong teams representing the Cleveland area at USIC too. In Columbus, Jim Buxton coaches a couple of teams and assures the Ohio State finals fly smoothly. Down near Cincinnati, Joe Mekina, Bucky Servaites and even Walt Van Gorder have all answered the tough questions from kids.

Moving onto the Chicago area, the Aeronuts, IMAC and Bong Eagles are all assisting. Earlier this year Chuck Markos enjoyed an afternoon at Memorial Hall in Racine helping some novice team members from Wisconsin. Their coach was effervescent in her next day's e-mail messages.

Gym teacher, Denny Dock in Michigan and his father Ted Dock in Indiana have strongly influenced a couple of teams and have had local newspaper articles written on their success.

Detroit has been coming on strong with the local clubs being very supportive. Fred Tellier and other Cloudbusters have helped SO schools and assisted during competitions, Since Michigan has the greatest population of SO teams; I suspect the Detroit area to become another hotbed of activity.

Up in Minnesota, Bill Kuhl dedicates himself to educators and freeflight activities. Bill has been developing some websites to compliment the future.

Into St. Louis area we have Roy White, Gene Joshu and Larry Coslick who have all done excellent jobs with SO fliers. Roy and Gene have been my High School officials at SO NATS for the last few years and thanks to them the competition flies smoothly.

Jumping from the Midwest to the pacific coast we can thank Dick Baxter, Sandy Peck and the southern California fliers for not only mentoring but running area flying events for SO. Dick has patiently written to me about the goings on to keep me informed of trends, problems along with valuable suggestions. Way up in the northwest, Keith Varnau and the other Boeing "BEAMS" members have done an excellent job in supporting SO teams and other education based events. They plan to host special events in their large hangars and invite the local SO teams to come out for special trim flying sessions.

Thanks to these people and many others, the caliber of airplanes and fliers has improved dramatically. The event has matured over the last five years to a bonafide favorite. The increase in popularity also causes an increased need for mentors. Ask around anyone that is involved, these kids are sharp, willing and appreciative of anyone making any effort to assist them in winning.

I request, on behalf of the indoor freeflight community, that you share your knowledge with a budding indoor flier. It takes so little to leave a legacy.

If you need a place to start, check out Science Olympiad's website at <www.SOinc.org> and search for your state's director or go to the helper's site run by Thayer Syme at <www.sirius.com/~thayer/sotsa/soplanes.html>

One final thought. The larger national education competitions encompass many types of events besides just the Wright Stuff flying. There are occasions that a team may do well in flying yet because they were poor in other events that the whole team, the fliers included, cannot proceed any further in state or national competition. For many of these dedicated fliers, having another chance to fly, competitively, would be both a blessing and surely an inspiration. As a case in point, I understand that at the last Kent State Indoor Competition (near Cleveland, OH) over sixteen students flew in SO events and the competition overall was the largest one ever. The feedback I have received was that SO airplanes were always in the air striving for the highest timed flight and the mass launch event was equally impressive. I strongly urge that our own AMA contest organizers consider including *non-rulebook* events so that more of these young competitors get another chance to fly against their peers.

Just think how our own enthusiasm for freeflight will inspire them to fly their own dreams.

Hail to Freeflight Mentors Everywhere!

Tom Sanders, Science Olympiad National Supervisor-Aeronautics

The following was posted by Marty Sasaki on the Indoor mailing list on the internet:

This is probably common knowledge for folks more seasoned than myself, but it was new to me and I think it's worth sharing.

During USIC, I was talking to Fred Tellier while watching one of his F1D test flights. He would occasionally mention the current prop RPM. I finally asked him how he knew the RPM and he replied that he was using his stroke watch. "What's a stroke watch?"

It's also called a cadence watch, and is used in rowing to figure out the stroke rate of the oarsmen. With Fred's watch, you start the watch, and three "events", i.e. prop revolutions, later you stop the watch, and it reads out the stroke rate, or prop RPM in this case.

I told Ray Harlan about it and Ray pulled out a mechanical stop watch with additional marks on the dial that did the same thing. However, Ray likes gadgets (don't we all?) so he did a web search and found a source for these things. I also did a web search, but the search engines I used didn't measure up.

I'm sure there are other sources, but here's a pretty good one:

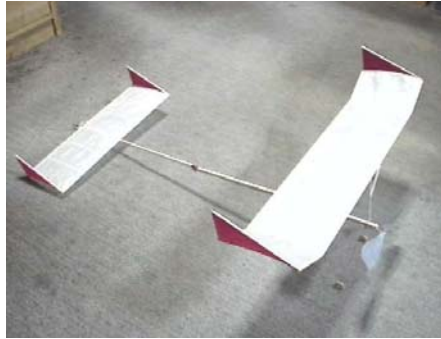
Go to <http://www.stopwatches.com> and click on Ultrak Stopwatches. There are two Ultrak stopwatches that have stroke capability, the Ultrak 495, which uses 3 events (it also has 100 dual/split memory, and time and calendar displays) for \$40, and the Ultrak 499, with selectable number of events (500 dual/split times, time, calendar, count up/down timers, lap speed modes, and an available computer interface as well as an available printer) for \$58.99.

PHOTO GALLERY

Here's some typical Science Olympiad photos, shamelessly copied from the website of the Cleveland clowns, and from INAV's files, too.



Glenn is the 2001 Georgia State Champion



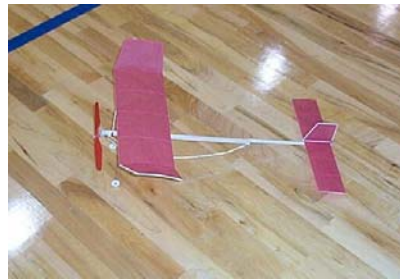
Akihiro's Science Olympiad Design Comes From Tokyo



Ben and His Bipe from Ohio



Brian Looks as Professional as Any World Champion



The Cleveland Clowns' Olympus Award Winning S.O. Design



Another Ben and His Bipe



Brian Ready to Launch His Bipe



Ray Harlan Demonstrating a Mini Stick to S.O. Fliers at USIC



Bill Gowen Not only Designs IHLG's, But Coached 5 S.O. Teams in Georgia

SCIENCE OLYMPIAD OHIO CONTEST REPORT

by Vernon Hacker
April 3, 2001



With this year's State Contest I will be finishing my third year of experience with the Science Olympiad program. I have only one regret. That regret is that we did not take photos of the builders first planes that were brought to events so that we could better show the evolution of our participants skills. Even this year we have seen the following covering materials used: The Cleveland Plain Dealer newspaper, Saran Wrap, wax paper and toilet paper. The varieties of glues used was also interesting and included every type of carpenter, white glue, pvc and cyanos. All of the above used in excess. We, the Cleveland Clowns, have offered our help to many schools but there is still a gap of knowledge that we have not been able to overcome. There are several schools that we have offered to help that have not responded to our invitations. Part of our effort to "level the playing field" was to sponsor a two day How-To-Do-It Clinic in January. Eleven coaches attended and were very satisfied with our effort. The great majority of that symposium's teaching was by John Kagan, Don and Chuck Slusarczyk. It was at this meeting that Don Slusarczyk introduced a C-D Rom that exquisitely shows the hows and whys of building and flying a Wright Stuff Plane. Don has also kitted an SO plane called 'Olympus'.

In the above paragraph I noted my personal disappointment in the fact that some schools have not been helped. But, on the other hand, we are very proud of the seventeen teams that have come from as far away as Columbus and Piqua, Ohio, to learn and to fly with us at The Andrews School for Girls at Willoughby, Ohio. Another unfortunate occurrence is the fact that we did not keep a record of the number of internet contacts that we have made. There are three regional Science Olympiad invitationals in northern Ohio. At those competitions the people that we have monitored have always placed high on the list. Our State Science Olympiad contest will be April twenty-first. It will be an interesting Wright Stuff competition as there will so many of our spin ups competing.

Spin ups to me is a title that I use for the five from our group that have developed an interest in Indoor Free Flight and will be going to the U.S.I.C. to fly A.M.A. events as well as the invitational Wright Stuff event. There are also two or three others from southern Ohio who plan to go to the U.S.I.C. This interest in indoor free flight flying is truly a "spin up" from the S.O. planes and is quite a different response from the A.M.A. Cub [Delta Dart] program. When I do a Delta Dart program I always leave my address, phone number and E-mail address. The numbers by now have to have exceeded three hundred. As yet I have never received a call for help. I know that there are some guys in Georgia who also are "spin ups" and are already starting to rewrite the record book. Those of you who are interested in records can watch out for the following names: Doug Schaeffer, Matt Chalker, Palmer Parker, Ben Saks, Alex Johnson, Brian Johnson, Dave Rigotti, Melissa Rigotti, plus a several names that have escaped this vintage 1922 cerebral computer. The Cleveland Clowns also had a postal contest for S.O. planes The total number of entrants was fifty one. That is in spite of little marketing on our part.

I have attended many indoor events including three of the internationals. I have had the pleasure of seeing my son win trophies and a national record, but the recent Science Olympiad experiences come close to being the most gratifying of all of them.

Cutting EZB Prop Blades Without Frustration

By Tim Goldstein (tim@IndoorDuration.com <http://www.indoorDuration.com>)

Cutting EZB prop blades from a blank has been a frustrating experience for me. The general technique I have always read about is to make a thin template and then use a brand new blade to just cut them out. Doing this I seem to continually have problems with the balsa blade material ripping and tearing. Besides frustration this also leads to heavy blades as I end up patching them and gluing the tears back together so as to not waste my precious EZB blade material. I have tried all the suggestions I have run across including not pulling on the razor blade but just pressing it down and not trying to cut the curve but just a series of straight lines. None of this seems to work for me.

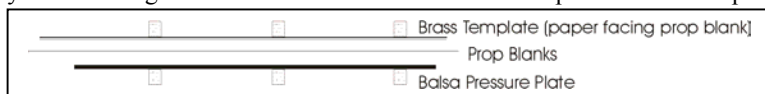
I had read quite a bit about the new type of magnets referred to as rare earth or neodymium magnets. So, I got hold of some of them for just general playing around and trying to see what uses I could find. What impressed me about these magnets beyond just their power was that a pair of even relatively little ones could be placed with quite a few pages of a phone book between them and they were still hard to separate and when you moved one the other on the opposite side of the pages would move with it. What does that have to do with EZB props you say? Well it dawned on me that I could use these powerful little magnets to clamp my prop blanks to a template that I could hold in my hand and then cut around the edge of the template with scissors cleanly cutting the .006" balsa without any tearing or splitting. I gave it a try and the results were beyond belief. Smooth cuts and nice curves without frustration or splits. So, now onto the how to do it.

To start you need to make a template that is the exact size of your finished blade. I made mine out of .010" brass shim stock as it is thin enough you can cut it out with a good pair of scissors, but tough enough to make a great template. To get the correct shape for the template I photocopied the blade outline and used double sided carpet tape to attach the photocopy to the brass stock. The attached paper is an important part of this process as explained later, so don't try to get by without it. Now I just cut the template out with a pair of heavy duty scissors.

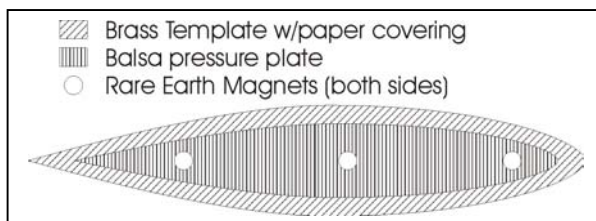
The next thing to make is a balsa piece I refer to as the pressure plate. I made mine from some scrap 1/16" balsa. This piece is cut the same shape as your template, but undersized so you have about .100" clearance from the edge of the template all around.

The last piece to this puzzle is the magnets themselves. I use 6 magnets that are about 1/4" in diameter and 1/4" in length. I have also used some smaller ones and they worked OK, but I like the tighter clamping I get with these little larger ones. The particular magnets are not critical, but I will warn you that if you get to any much larger they can be VERY difficult to separate and will have far more power than you really need. These magnets are readily available from a variety of surplus houses and vendors on the Internet.

You are now ready to cut out the cleanest set of blades you have ever made. To start grab the template with the paper covered side facing up. It is important to have the paper face of the template against the prop blanks or you may get the blanks shifting while you are cutting due to the smoothness of the brass template stock. Next place the pair of prop blade blanks on the template. Now,

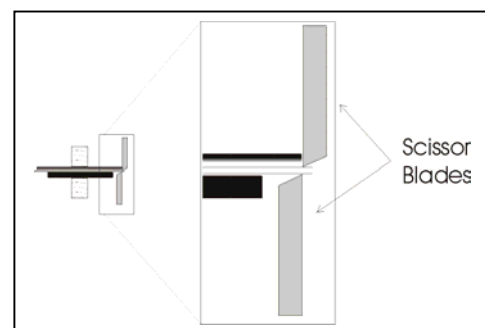


holding the assembly up to the light, place the balsa pressure plate on the stack using the outline of the template you see through the blanks to allow you to align the pressure plate evenly. Holding the



complete stack in one hand grab one magnet and place it on the stack in the middle on top of the balsa plate. Then grab another magnet and put it under the stack against the brass template. The 2 magnets will pull together with enough attraction to tightly clamp it all together. Now add the additional sets, one at each end, to keep everything from slipping. When placing the magnets be very careful as the attraction is so great they will try to jump out of your fingers.

Now comes the fun part. Grab the best, sharpest pair of scissors you own. I use a set of Fiscars as I find them sharper than the imitations. I start at the inner blade tip on the right side and cut in a counter clockwise direction. This allows you to have the top scissor blade ride against the brass template and the lower blade comes up from the bottom exactly in line with the template outline. I now proceed to cut all the way around. Take extra care as you cut the curve at the tip to not turn the scissors to follow the template faster than you are cutting with the blades. Once you get all the way around remove the magnets to see the cleanest set of EZB blades you have ever cut.



WILLAMETTE MODELERS TWO DAY INDOOR MEET
ALBANY, OREGON - APRIL 28,29 2001
Reported by John Lenderman, Contest Director

The doors to the gymnasium were to be opened at 11 A.M on Saturday, but when I arrived, there were several modelers waiting, with their model boxes, ready to get in and set up their spaces. This was at 10 A.M, and before the doors finally opened, we had a good group of flyers in the midst of discussions about models, the welfare of others, and what they had been doing with their lives. Frank Hirleman had recently moved from Lincoln City to Sequim, Washington, and drove to the contest that morning, a distance of 360 miles! There were others who had come the night before and were anxious to get into the swing of things. Bob Stalick, whose wife was in the hospital for treatment for Leukemia, came down to help get the contest going, and to give last minute instructions to the officials in their duties. He is staying in Portland with a relative during Barbara's treatment time. Glenn Grell was there to handle some of the paperwork necessary to run an orderly contest, and was invaluable in the final compilations of the results. Several other members of the club were there to time and do the scale judging. Needless to say, there was a busy time the first few hours getting things organized, and entering the contestants.

Later in the morning and early afternoon, we began to realize the amount of work Bob does in getting a contest under way and running smoothly. We had a record number of contestants this year, and many came long distances to attend. Gordon Dona flew in from Minnesota to Seattle where his brother and father met him and his models. They all drove to Albany together, with a lot of model boxes and luggage. As mentioned before, Frank Hirleman came from Sequim, Washington, several others from the Seattle area, three from California made the journey to this premier event. Fred Hollingsworth and his wife, Phyllis, drove from British Columbia, and said they really enjoyed coming here because of the good flying site, but mainly for the good friends and pleasant time. All four walls of the gym were solid with tables and chairs, and a few had to use the pull out bleacher seats for their work areas. Once everyone had settled in, the flying began, and there were models in the air at all times. Since our format for this competition was for general flying on Saturday, and regulated flying times for Sunday, the light and heavy models had to share air time together. For the most part this worked out pretty well, and there were very few incidents involving the models. As we had noticed previously, most were polite, and waited for the air to be cleared before launching, so things ran smoothly for the Saturday flying. We flew until 5 P.M. when we broke for supper, returning at six to start the symposium.

We had a good number turn out, and they were rewarded with some interesting and provocative discussions. Ed Berray showed his adjustable form for covering Mini-stick wings, and the method he used to prepare the film for transfer to the forms. He used thinned out rubber cement to attach the film to the wing structure—the cement being thinned to the consistency of water. Ed also talked about his experiences with the new Science Olympiad event. He stressed that the flying surfaces be kept straight, with just a slight amount of wash-in on the left wing panel. Ed has been working with the schools in Vancouver, Washington, and helping middle schoolers and high schoolers in construction and flying of these models.

Next, Ken Hark gave us some of his tricks of helping in the building process. For attaching blades to prop spars, he demonstrated his clamp, made from a small piece of wood. Across one end he glues a strip of wood, then splits the small piece of wood up to the cross piece. This gives enough tension to hold the blade to the spar, while the spar is in the prop jig. To hold the rest of the blade, he had a piece of thread attached to the 45 degree pitch gauge that goes over the blade into a small piece of balsa slit to receive the thread. If you have trouble making accurate wing posts, he devised a method to insure that they areround and even. He has a small piece of brass, about one sixteenth thick, which he drills a hole the size you want for the wing post. He doesn't dress the burrs on the other side where it is drilled. You then take a square piece of balsa of the size needed, and twists it through the brass, with the burrs shaving of the wood edges to produce the nice round, even, wing posts. Very clever. Ken also stressed the use of insect pins for holding balsa pieces in place. Most pins are .009, and make very small holes, but holds things in place very well. Ken then told of his method for keeping the glue bottles clear of clogs. When he used the glue gun, he afterwards puts some acetone on the glue tip to clear the tip for the next use. In extreme cases, he lets the tip soak in acetone for a while to clear it. Ken then told of how he keeps his carbon razor blades sharp. He has a small honing block with two grades of sharpening material, and strokes the blade on both sides to get them sharp again. Gordon Dona showed a tapering block his brother Steve made, with an adjustable base, that can make tapered spars, or prop spars, to whatever you need for sizes at either end. Andrew Tagliafico then demonstrated how he makes the pigtail bearings he uses. Instead of a clamp that is no longer available, he used a small dowel that is split to receive the wire

used in the bearings. It is held in a small vise, and the pigtail wound around the wire. Andrew tells us the whole procedure will be published shortly in one of the magazines. Ed Berray also showed us the way to use a quarter motor balancer and spacer to use in the quarter motor events. After the symposium, the flying commenced again, and when the last modeler had flown, it was 11:37 P.M., and time to get some rest.

At 8:15 next morning, the competition began again, with hand launch and catapult gliders. I'll give a run down of the events, beginning with the ones that had the most contestants. Fifteen modelers entered the A-6 event, and most had their models flying well. Andrew Tagliafico, with his new design, topped everyone with a great flight of 7:03. A number of other modelers had built this design, and all flew with great potential. In second was the CD with his Minnie Thrush with a time of 6:43.4, and third was a new flyer from the Seattle area, Bruce McCrory, with a nice flight of 6:33. Bruce is a modeler to watch, as he is learning quite fast, and has a real interest in getting better. The Mini Stick event brought out 13 flyers, and again Andrew was tops with a nice time 9:29. His new design really is a good flyer, and very stable. His rival, Ed Berray was second with a 8:31. Both of these flyers once held the Cat. II record, flown in this building. Chuck Dorsett, from Walnut Creek, California, came in third with 7:58. Several flyers noted that the conditions in the building were not conducive to record flights. There were also 13 flyers in the Limited Pennyplane event, which was won by the CD with the only flight over 4 minutes—4:18. Close behind was Steve Dona, flying a new model, with a very good time of 3:53, and then Ed Berray with 3:39. This event is flown with quarter motors also. It is interesting to see the variations in the designs, especially with the limitations in the rules. Some are using the tail boom to lower the stabs out of the wing wash. They angle the boom quite a bit, then support the stab with extensions from the boom. There may be some merit in this. In the regular EZB event, the times were not particularly real high, probably because of the conditions in the building. We never saw the buoyant air that sometimes happens during the day. The winning time of 6:59 was acceptable, but we were hoping for something better. Gordon Dona got his act together late in the day with a 6:16 flight, but last year this model did a 6:54. In third was Ed Berray with a 4:42.8 flight, and he was disappointed, because his model had done over 7 minutes in previous years. These models also flew with quarter motors.

There was a good turnout for Peanut Scale, with 9 entries, and Mark Allison, flying his Chambermaid, topped everyone with 55 total points. Mark is such a steady flyer, and is well prepared for this competition. Tom Kopriva was second with his Fike, model E, and Bob Carpenter, with his S.E.5 was third. Bob had flown in the Albany contests some 20 years ago, and has started back again. He lives in Welches, Oregon, and does an excellent job of building. He also has lots of fun flying. In the new 1.2 Gram EZB event, with quarter motors, the winner with a new model and design was Andrew Tagliafico, with a great time of 6:26. Andrew is very patient when testing new models, and this proved his point when the model performed to his expectations. Jerry Powell flew his English design to a good time of 6:08.6, and some very steady flying. Third was John Lenderman, flying some old model parts, made to conform to the 1.2 rule, with a flight of 5:27.

The Science Olympiad event was again won by Chris Borland, from Sacramento, with 3:10 flight. Chris has been very consistent in this event, and he also won the mass launch at noon with his design. Second was Ken Hark, with a flight just over the three minute barrier, a 3:00.9. Third was Mark Allison with 2:48. There were 7 Bostonian entrants, and no one went over the 3 minute mark. Steve Dona got close with a 2:52, and Jerry Powell, usually the winner in this event, had to settle for second with his flight of 2:43. Third was Gordon Dona with 2:31. Seven entrants flew No-Cal scale, and Mark Allison was first with a very nice 4:36. He flew his Heinkel. Tom Kopriva got out his Fike E and put up a very good 4:02 for second, and Gordon Dona flew his Shinden to third place with a 2:21 flight. Ed Berray shows his class in catapult glider event with great consistency in posting a 75.49 two flight total. Gordon Dona gave him a run for the gold with a good total of 74.64, and Mark Allison, flying a model with a small canard in front, was third with 70.00. The A-ROG event had five flyers with good models, but the topper was Andrew Tagliafico with a fully wound flight that escaped some dangerous situations, and eventually touched down at 14:35, for a great flight to just about duplicate his win a few years ago of 14:32. In second place) flying a 25 year old model, was the CD, with a nice time of 11:29.6. Jon Sayre was third with a nice model, and good flight of 10:14. Hand launched glider provided a great deal of suspense, as Jonathan Sayre, Gordon Dona, and Ed Berray battled it out. With some excellent flying they placed one, two and three. Jonathans two flight total was 86:36. Other events will be shown in the results.

WILLAMETTE MODELERS TWO DAY INDOOR MEET RESULTS

A-6 EVENT (15)*

1. Andrew Tagliafico	7:03
2. John Lenderman	6:43.4
3. Bruce McCrory	6:33

EZB (9) 1/4 motor (9)

1. John Lenderman	6:59
2. Gordon Dona	6:16
3. Ed Berray	4:42.8

SCIENCE OLYMPIAD (7)

1. Chris Borland	3:10
2. Ken Hark	3:00.9
3. Mark Allison	2 :48

CATAPULT GLIDER (6)

1. Ed Berray	75.49
2. Gordon Dona	74.64
3. Mark Allison	70.0

DIME SCALE (3)

1. Mark Allison	1:44.7
2. Bob Carpenter	0:29

EMBRYO (2)

1. Frank Hirleman	259.1
2. Jerry Powell	239.6

NEW CANADIAN RECORD

*Number of contestants
+ New site record

MINI-STICK (13)

1. Andrew Tagliafico	9:29
2. Ed Berray	8:31
3. Charles Dorsett	7:58

PEANUT SCALE (9)

1. Mark Allison	55 Pts.
2. Tom Kopriva	47 Pts.
3. Bob Carpenter	46.7 Pts.

BOSTONIAN (7)

1. Steve Dona	2:52
2. Jerry Powell	2:43
3. Gordon Dona	

A-ROG (5)

1. Andrew Tagliafico	14:35
2. John Lenderman	11:29.6
3. Jon Sayre	10:14

AMA SCALE (3)

1. Mark Allison	1:57.98
2. Tom Kopriva :	0:27.62

INTERMEDIATE STICK (2)

1. Dave Hagen	13:49
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LIMITED.PENNY PLANE (13)

1. John Lenderman	4:18
2. Steve Dona	3: 53
3. Gordon Dona	3:39
3. Ed Berray	3:39

1.2 GRAME EZB (8)

1. A. Tagliafico	6:26 +
2. Jerry Powell	6:08
3. J. Lenderman	5:27.8

NO-CAL SCALE (7)

1. Mark Allison	4:36
2. Tom Kopriva	4:02
3. Gordon Dona	2: 21

HAND LAUNCHED GLIDER (5)

1. Jonathan Sayre	86.36
2. Gordon Dona	81.70
3. Ed Berray	63.88

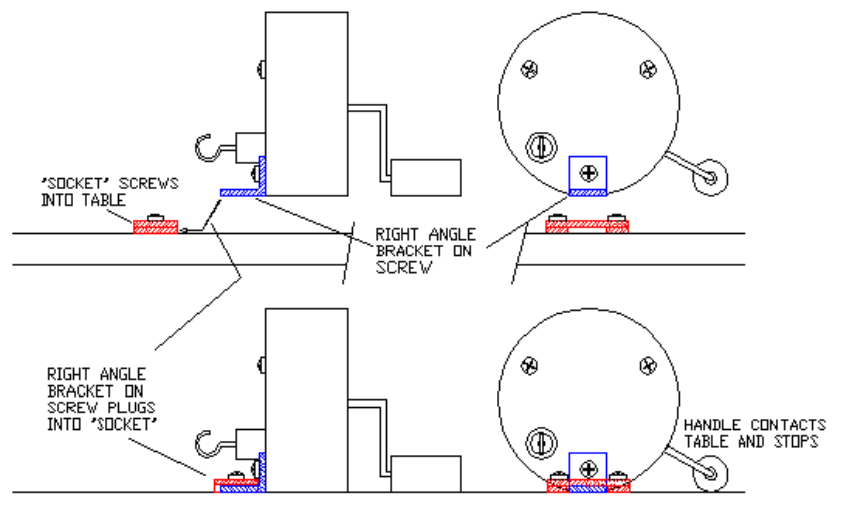
MOORHEAD EVENT (3)

1. Mark Allison	583.2
2. Frank Hirleman	42.4
3. D. Klingenberg	28.5

Limited Pennyplane
Fred Hollingsworth 8:34

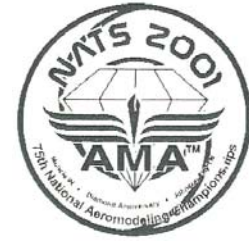
A Holder/Handle Brake System

Bill Dodson writes: This is the holder/handle brake system that Larry Cailliau uses, which I drew up for a friend. It is simple, neat, and works well. Larry made his from an aluminum angle and three pieces of flat sheet for the socket. The screw that holds the angle bracket on must be replaced with a longer one.



Larry Cailliau Design, drawn by Bill Dodson

U. S. INDOOR CHAMPIONSHIPS, JOHNSON CITY, TENNESSEE



Several weeks before the Johnson City Nats, I wrote a letter to Dave Thomson the Contest Director, asking for permission to set up an INAV table to sell subscriptions and the brand new CD archive. Dave wrote back a very warm letter saying he would do anything he could for the newsletter, and give me a free table set up at the 50-yard line, right next to the sign-in area. He was good to his word. Tuesday evening we came in to check out the site, drop off our model boxes and set up. Wednesday, May 30 was Day One, and everyone stopped by to chat, visit, and reach for their wallets. We sold seven archive CD's and twelve subscriptions that first day alone. Associate Editor Steve Gardner also did well with his indoor clip art and T-shirts. It proved to be the start of a busy week for everyone.

The morning of Day One had the air filled with hand launched and catapult gliders. Jim Buxton won Hand Launched Glider with a best two flight total of 163.5 seconds. Standard Catapult was won by Ralph Schlarb with a two flight total of 163.4, and Unlimited Catapult by Kurt Krempetz with 174.4. Glider technology has really advanced. Look in the middle of this issue for three very competitive designs. The minidome also was filled with shouts of glee as the new rubber speed events took place, now in their second year, I believe. Only four hit the tarp in Straight Line Speed. Jim Lewis won, with Tom Sova, Dave Linstrum, and John Blair following. Jim also won Round the Pole. Unlimited Rubber Speed was won by John Diebolt, with John Blair second. Race To The Roof was harder than you might think—116 feet is a long way! Eight people tried but only five made it. John Kagan won in 6.9 seconds, followed by Jack McGillivray, Dave Linstrum, Fred Rash and John Diebolt. One of my favorites, P-24 condor set a new record of over six minutes this year. John Diebolt put over 7400 winds in his motor to accomplish this feat. Perennial winner Jim Clem got second place.

Wednesday afternoon and evening saw a close competition in 35 CM, with Larry Loucka edging out Tom Sova for first place by only 10 seconds, with a best time of 23:17. Intermediate Stick was dominated by John Kagan in first, followed by Fred Tellier and Jim Richmond. John's best time was 38:47.

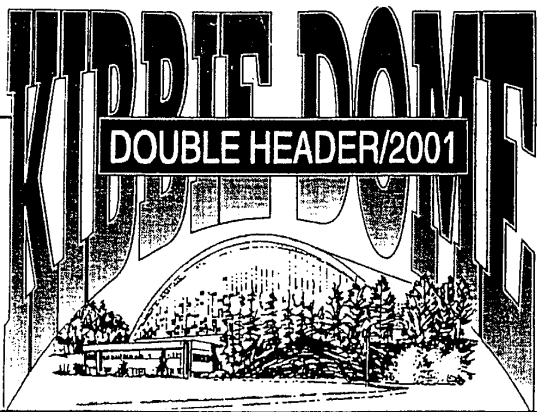
Thursday's competition began with two days of much-needed rain, which cooled the dome and kept inside temperatures pleasant throughout the meet. FAC and AMA scale events went on for three days. Canadian Jack McGillivray won Golden Age, FAC and Dime Scale, as well as the WW II Mass Launch. Rich Miller won FAC Peanut Scale, Coconut Scale, Bostonian, and Bostonian Mass Launch. Emil Schutzel wowed us with a Pioneer Scale win with his Santos Dumont 14bis canard. Jim Miller and his Lacey won AMA Peanut Scale. Thursday evening, Tom Sova put up two identical F1D flights of 28:51 and 28:52 to win, followed by John Kagan in second place and Richard Doig in third. Larry Loucka won Cabin ROG with a 29:49, Vlad Linardic won HL Stick with a 37:26, with Tom Iacobellis placing second in both events. Tom's son, Vito put up a very respectable 13:46 in Limited Pennyplane, and beat your editor in Ministick with a 6:20 best flight. Watch those Juniors!

Friday morning saw 28 fliers duke it out in the ever-popular Ministick event. East Coast Indoor modeler Rob Romash put up an amazing 12:37 early on, which scared everyone except Walt van Gorder, who did a 12:36. In all, seven fliers broke 10 minutes. Walt was credited by the AMA with winning the Ministick Mass launch, but we hear the real winner was Larry Loucka. Sorry, Walt. Speaking of watching Juniors, Parker Parrish is the hot Senior to watch from North Atlanta, and he almost made the 10 minute club with a 9:26 posting. That afternoon Parker went up against 26 of us in EZB to pull out a 12th place with a 21:22. Rumor has it he will do no better until his planes stop their love affair with the ceiling girders. Larry Cailliau won EZB easily (little pun, that) with a 29:55. Vladimir Linardic repeated his HL Stick form when it came to FIL and won with a best two-flight total of 42:38.

Saturday had a nice change of pace when Dave Linstrum of the MIAMA group called on Tom Sanders and over 50 of the Science Olympiad champs to an invitational flyoff at the Minidome. Sixteen teenagers showed up, and put up some impressive three and four minute flights. Results are not in yet, but we hope to have them by the next issue. Even better, several SO champs stopped by the INAV booth and signed up at the reduced \$6.00 yearly rate.

Limited Pennyplane on Sunday was the hottest event. A total of 50 entrants competed with only 9 seconds separating the top three finishers. Tom Sova got first with a 15:01, Larry Cailliau second with a 14:56, and Vlad Linardic third with a 14:52. Also on Sunday the F1M event had the top three finishers all beating the 27 minute mark in two flights. Like Parker Parrish, Bill Gowen is from Georgia and won with a 27:49, followed by Fred Tellier from MAAC in Canada with 27:15 and John Diebolt with a 27:06 two flight total. Many thanks to Fred, who is not only a great indoor guy, but is also computer-friendly, and has shared his Tan II rubber testing with INAV. His energy numbers are among those listed on page 26 in this issue.

Look for complete results plus photos in issue 103!



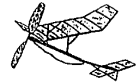
ANNUAL JULY 21 THRU JULY 24, 2001
UNIVERSITY OF IDAHO, MOSCOW, IDAHO
KIBBIE DOME OPEN FOR FLYING - 8:00 AM TO 8:00 PM

MEET 1. (July 21 thru July 24) Kibbie Dome Annual
 All AMA Indoor Events. 6 official flights per event (Can be flown all 4 days, 9:30 am, to 8:00 pm)
 Hand Launched Gliders and Catapult Gliders flights 8:00am to 9:30 am only, all four days. 9 official flights allowed.
SPECIAL EVENTS: A-6 and Non Radio-Controlled Electric F.F. (30 gram max weight for Electric F.F.)
ENTRY FEE: Open & Senior - \$60.00, Junior flyers - \$25.00. Table & 2 chairs rental \$5.00. There are no additional event charges.
CONTEST DIRECTOR: Andrew Tagliafico, Phone 503-452-0546 for additional information. Modest prizes will be awarded.
FLYING SCALE CONTEST DIRECTOR: Dave Haight, Phone 208-744-9026 for additional info. Flying Aces Rules will be used. Static Scale Judging will take place prior to flying.
DISTRICT XI F1D REGIONAL will be held during the Kibbie Dome Annual. 55 cm Wing Span, 1.2 gram min. weight with 0.6 gram rubber rules will be in effect. Models will be processed.

MEET 2. (July 22 & 23) International Easy B, 1.2 gram. Six official flights allowed. Official flights to be flown: Three on Sunday, July 22 & three on Monday, July 23, between 9:30 am & 8:00 pm each day. Models will be processed per AMA-EZB rules plus minimum weight of 1.2 grams. Junior, Senior, and Open combined. No additional fee required if entered in the Kibbie Dome Annual. This event only entry fee: \$20.00 plus table & 2 chairs if required. Special plaques awarded to third place.



"A Well Kept Secret"



- INDOOR FREEFLIGHT -

Come fly with us, (or just observe and see what it is all about)!

For 29 consecutive years, M.I.A.M.A. (Miami Indoor Aircraft Model Association) has been holding indoor model airplane contests in Florida. Currently, the Association sponsors about 7 two-day contests in the Tampa Bay Area each year. They are held in various locations such as the aircraft hangars at the U.S. Coast Guard, Clearwater and Delta Maintenance, Tampa and other sites such as Homer Hesterly Armory, Tampa and State Fairgrounds, Tampa.

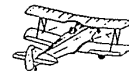
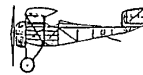
If you are an old "stick and tissue" modeler or a just a beginner, you might find something of interest for you in the many classes of models flown. Detailed scale models from the 8" Pistachio class to the 36" Coconut class are flown in addition to the feather weight endurance models weighing less than a gram. Many AMA National Indoor records have been set at these contests. However, you will find lots of friendly help for newcomers.

For more information on these activities and future contest schedules, you can contact:

Hillsborough County - Newt Bollinger 813 685-4164
Pinellas County - Don Brimmer 727 525-6667
Sun City Center - Dick Obarski 813 634-8683
Manatee County - Rich MacEntee 941 723-0764
Sarasota - Sidney Gilbert 941 355-0554

or write to: "THE HANGAR PILOT" Editor: Dr. John Martin, Jr.
 (Or subscribe- 1yr. \$12.50 - lots of plans, 2180 Tigertail Ave.
 tips, 3-views, articles, contest information) Miami, FL 33133

Think about it - Wind or rain is never a problem and no one yet has suffered a sunburn. Check It Out !!!!!



RanRan 70 by Akihiro Danjo

This is my 3rd indoor unlimited class catapult glider. My 1st unlimited class model was 45cm span and did about 45sec at a 12.85m gym. And 2nd model was 60cm span and did about 50sec at the same site. So I thought that building larger model would be the way to go.

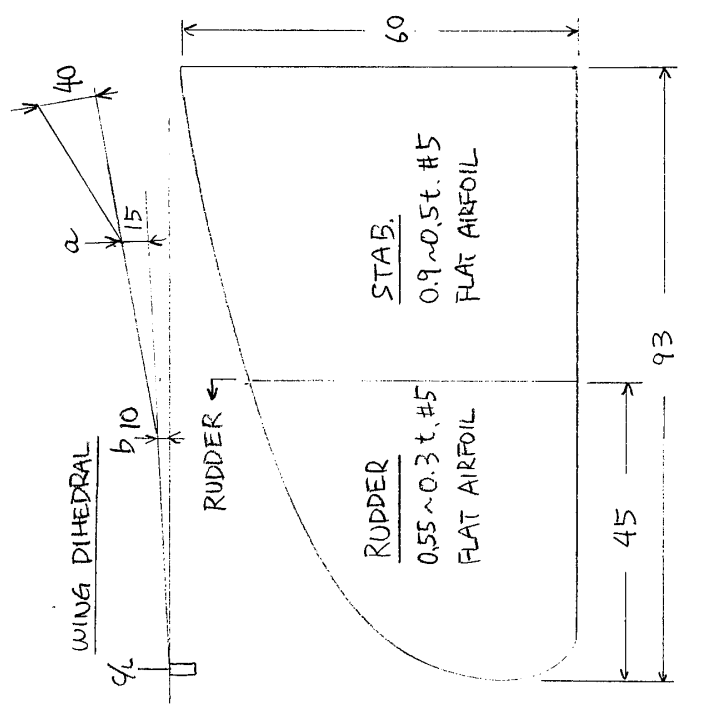
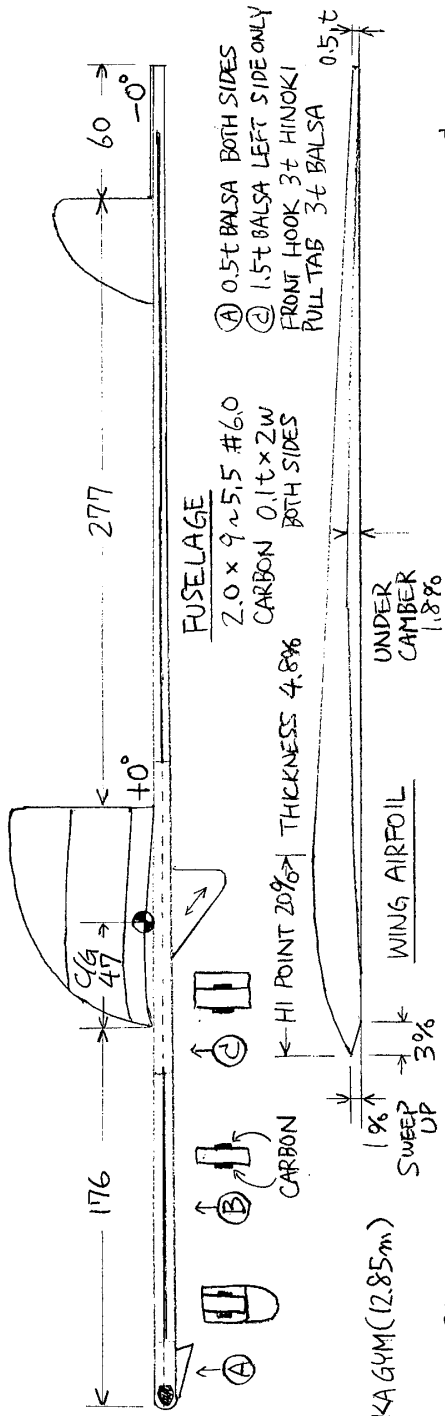
When sanding the bottom of the wing, the trailing edge waved heavily. I was disappointed to find the wave and stopped sanding. Fortunately, I could cure the waving (except the center panels) when the wing was cut into 6 parts, though it was slightly heavier than I expected. The washin of the center panels are not intended, but it must have helped the performance. The wing has a removable (adjustable) wing mount system, but I cannot write about it here because it is designed by Stan Buddenbohm (USA). If you want to know about it, please order LIT'L-SWEEP plan (and other plans, too!) from him. I use about 6 inch long loop of 3/16 inch Tan2 rubber to catapult my model to 12.5m, about 70 deg up and 20 deg right bank. Adjust the circle as wide as possible.

This model did 66.8 + 66.8 sec = 2:13.6 (best2 from 9) at a 15.8m ceiling gym. So it proved to be able to do over 2 minutes if I could find a 15m (=cat2 limit) site.

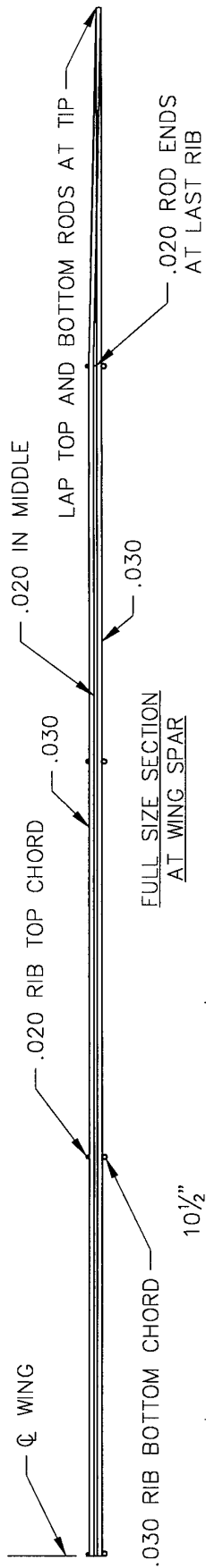
Shooting Star
Ranran 70
 UNLIMITED CLASS
 CATAPULT FOR CAT2
 BY AKIHIRO DANJO

RECORD AT YOKOHAMA BUNKA GYM (2.85m)
 ON 20. JAN. 2001
 54.9 + 56.3 = 01:51.2 (BEST 2 OF 9)

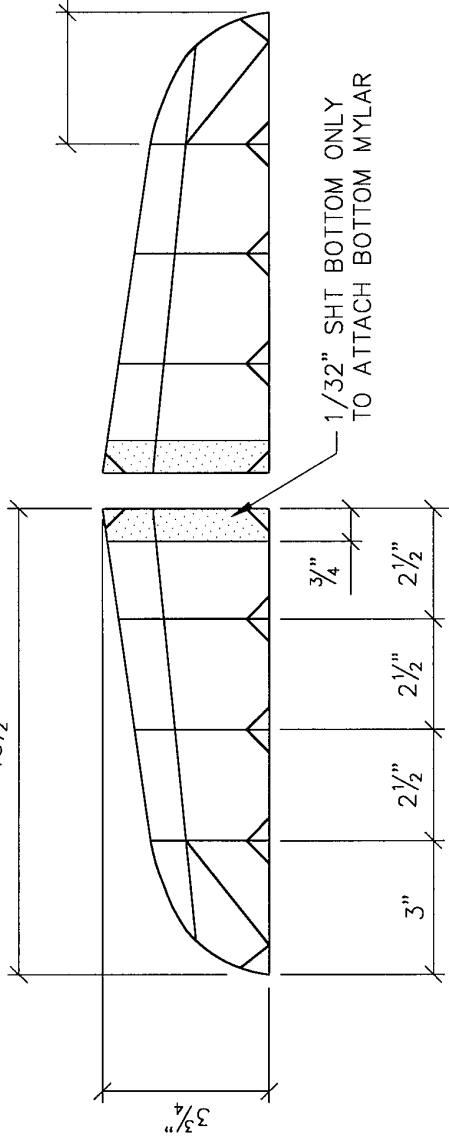
WEIGHT: 11.7g



流星蘭 70号
 BY 檀上彰宏



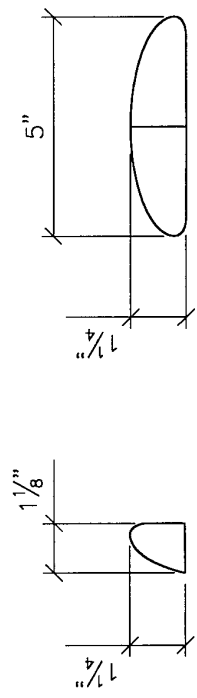
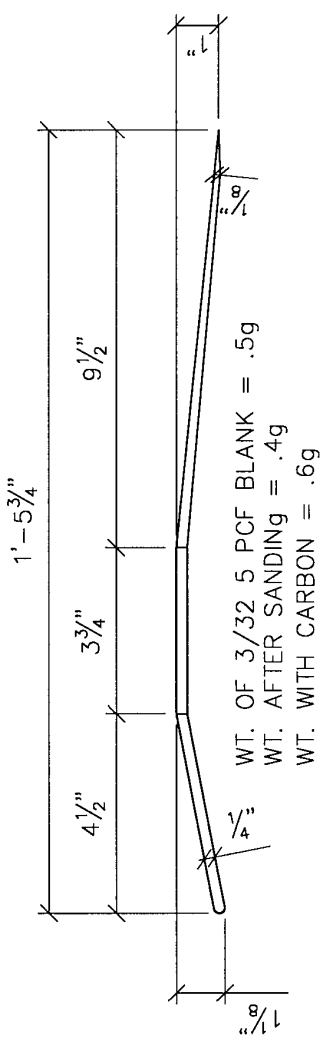
THIS PORTION OF L.E. IS .030 OR .020 CMR TO FACILITATE BENDING (SPLICE AT RIB)



WING
 AREA = 60 SQ. IN.
 RIBS = .030 BOT, .020 TOP = .8g
 SPAR = .030 + .020 + .030 CMR = .65g
 LE = .040 CMR = .7g
 TE = .030 CMR = .3g
 MISC. BRACES .020 CMR
 TOTAL = 2.4g
 .000059 MYLAR = .2g
 PROJECTED FINISHED WT = 2.6g
 ACTUAL FINISHED WT = 2.99g

FINISHED GLIDER

ACTUAL WT LESS BALLAST = 3.8g
 ACTUAL WT W/ BALLAST TO 50% CG = 4.2g
 ACTUAL WT AFTER FLIGHT TRIM = 4.3g



RUDDER

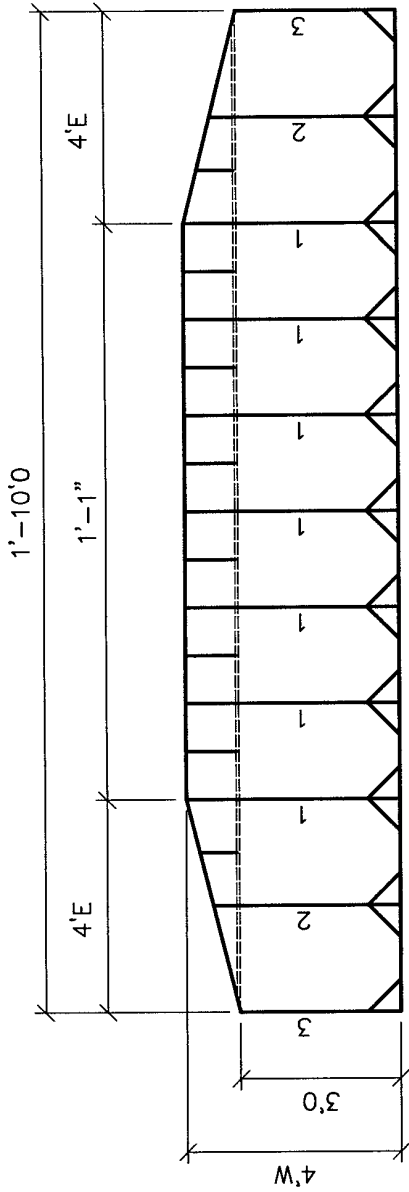
STAB

SCALE 1"=4"

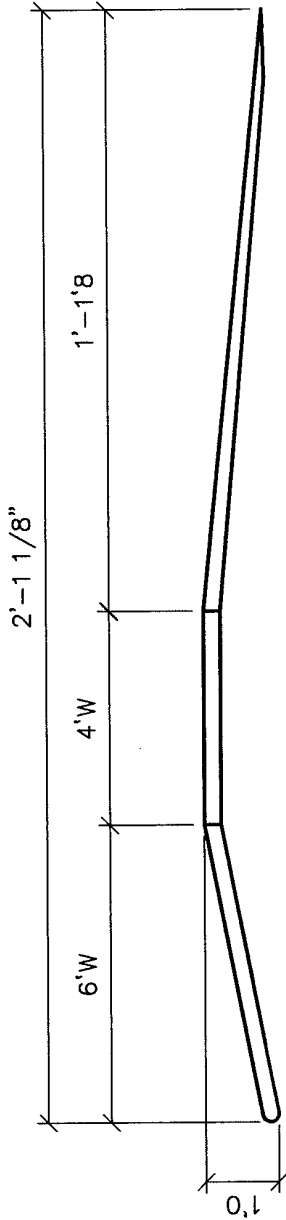
FINISHED WT. = .15g

"CARBON COPY"

BASED ON 1980 "UPSTART 4"
 WITH CREDIT AND APOLOGIES GIVEN
 TO MARK DRELA



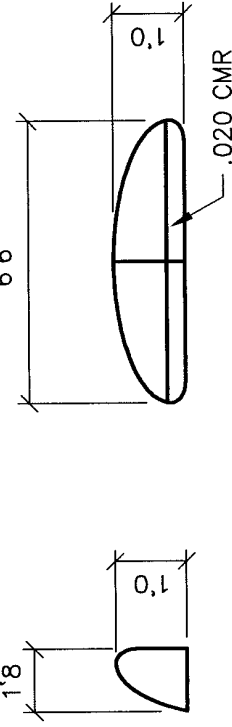
2" DIHEDRAL EACH TIP



WT. OF 3/16 5.7 PCF BLANK = 2g
 WT. AFTER SANDING = 1.1g
 WT. WITH CARBON = 1.3g

WING

AREA = 100 SQ. IN.
 RIBS = .020 BOT, .020 TOP = .8g
 SPAR = 2 x .030 + 1 Balsa = 1.3g
 LE = .040 CMR = .7g
 TE = .030 CMR = .3g
 Balsa TIP RIBS = .4g
 Balsa TIP RIBS = .1g
 MISC. BRACES .020 CMR = .1g
 .000059 MYLAR = .3g
 PROJECTED FINISHED WT = 4g
 ACTUAL FINISHED WT = 4.35g



RUDDER

STAB

FINISHED WT. = .4g

FINISHED GLIDER

ACTUAL WT LESS BALLAST = 6.1g
 ACTUAL WT AFTER FLIGHT TRIM = 7.25g

"LITE CARBS"

BY BILL GOWEN

SCALE 1"=4"

Carbon Copy and Lite Carbs by Bill Gowen

Here is some info about my new IHLG's with carbon rod wings. A lot of people have commented on the high level of craftsmanship in these gliders. Actually my craftsmanship is highly suspect, but I've got a fertile imagination and a lot of guts! I did a lot of unsuccessful experimenting before hitting on this idea. These are the only two examples built so far. The wings are very strong but also very flexible. It takes a lot of care to keep them straight, especially when shrinking the covering. Ultrafilm has been my most successful covering material. It has a very gentle pull even when shrunk tight. If I get around to doing an outdoor version, I will probably use .00025 mylar.

Carbon Copy is based on the planform of Mark Drela's Upstart 4 but has a simple flat bottom airfoil. The ribs are built up as you go by cutting lower rib chords to fit between the LE and TE. The spar is then added by gluing a stack of three rods to the rib lower chord. I do this by putting them in one at a time. The rib top chord is then glued to the LE, bent over the spar and glued to the TE. The whole airplane took about 4 hours to build. Carbon Copy has been flown several hundred times with no structural breaks in the wing. Further weight reductions are possible by using smaller rods. It has 60 sq. in. of wing area and weighs 4.3 grams (the Upstart 4 weighed 5.5 grams). It was originally conceived as a Cat I glider. The best time so far in a 22' flat ceiling gym is 27 seconds, but it has not been in a Cat I competition yet. It currently holds the Georgia state Cat II record at 65 seconds for 2 flights. Currently my maximum launch height is about 30'. At the Peach State Indoor Championships Carbon Copy had it's tail boom cracked, then the stab torn off, and then the boom broken in two. At that point I switched airplanes to Lite Carbs even though I didn't feel that Lite Carbs had the altitude potential to do the job in Cat II.

Lite Carbs has a more ambitious airfoil that required building the ribs first. That's the main reason I went with a constant chord center section - not as many ribs to figure out. It took about 2 days of concentrated effort to build, and all but about two hours of that time was in building and covering the wing. Matt Gewain of CST suggested the balsa half ribs to better control the airfoil in the critical leading edge area. The main ribs are .020 carbon rods laminated to 1/32 balsa forward of the spar. The spar is 1/16 balsa with an .030 rod top and bottom. The airfoil came from a catapult glider called the Inside Sling as published in INAV. It has 100 sq. in. of wing area and weighs 7.3 grams. During preliminary outdoor tests, I threw Lite Carbs into a telephone pole at full power with no damage. At the Peach State Indoor Championships, an all out, maximum, knee busting throw would get it up to around 30'. Reaching the ceiling in a 22' gym requires only a gentle toss.

All the carbon rods came from The Composite Store. . Glue used was Balsa Gold thin CyA. Mylar came from Model Research Labs (www.modelresearchlabs.com/). Curt Stevens at MRL has a dim view of this project if you want a dissenting opinion (Curt's projection: "no climb, no glide, it'll never break 30 seconds"). Film was attached with 3M 77.

If you have the itch to try one of these airplanes, feel free to experiment as you go. This is a whole new concept in construction and there are lots of avenues to explore. Just let me know if you find out something useful! I'm thinking about beefing up the planes a bit and taking them to the Nats just for fun. Very thin sheeting on the LE is a possibility.

One important addition: carbon rods do not like heat, especially if they are bent. I've had to replace the bent tips on Carbon Copy several times after ruining them with heat. I now trim the Ultrafilm with a razor blade instead of a hot wire. Also, in the process of setting the wing shape with heat, I have caused the tips to fail. A wing shape without curves is safer to work with if you are planning on any kind of heat.

Materials specs for both planes and competition results are on the next page.

Carbon Copy Specs

CMR = Carbon Micro Rod
Ribs = .030 CMR Bot, .020 Top = .8g
Spar = 21" .030 + .020 + .030 CMR = .7g
LE = 15" .040 + 9" .030 = .7g
TE = 21" .030 CMR = .3g
.000059 Mylar = .2g
TE Braces = .1g
Total Materials = 2.8g
Actual Finished Wing Wt = 3.0g
Fuse And Tail = .73g
Actual Total Wt Less Ballast = 3.77g
Actual Total Wt After Flight Trim = 4.3g
Area = 60 Sq. In.
Loading = .072g/si, .36oz/sf

Lite Carbs Specs

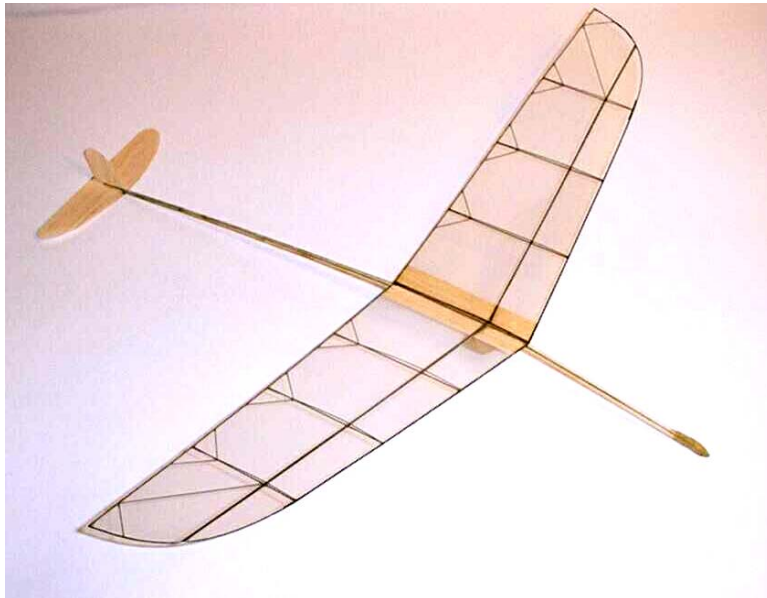
CMR = Carbon Micro Rod
Ribs = .020 CMR Bot, .020 Top + 1/32 balsa = .8g
Spar = 22.6" 2 x .030 CMR + 1/16 Balsa = 1.3g
LE = 22.6" .040 CMR = .7g
TE = 22.6" .030 CMR = .3g
Balsa Tip Ribs = .4g TE Braces = .1g
1/32 Center Sheeting = .4g Balsa Half Ribs = .1g
Total Materials = 4.1g
Actual Framed Up Weight = 3.9g
Ultrafilm Both Sides = .3g
Total Finished Wing = 4.35g
3/16 Fus Blank = 2.3g
Sanded Fus = 1.1g, Finished Fus = 1.3g
Stab = .35g
Total Less Ballast = 6.1g
Total After Flight Trim = 7.25g
Area = 100 Sq. In.
Loading = .073g/si, .37oz/sf

Contest Results

3/17/01 TTOMA indoor meet at North Springs HS (35' Cat II) – Carbon Copy 1st place with flights of 32.0 + 33.0 = 65.0 seconds total (Georgia State Cat II record)

4/14/01 Peach State Indoor Championships at North Springs HS – Lite Carbs 1st place with 29.8 + 32.3 = 62.1 seconds total.

5/30/01 U.S.I.C. Unlimited Cat. Glider - Carbon Copy catapult version – 44.2 seconds.



2 Product reports on the INAV Archive CD

by **Marty Sasaki**

What is the most valuable published resource for indoor modeling?

Some would say Ron Williams' "Building and Flying Indoor Model Airplanes." It is packed with building and flying instructions, plenty of photographs, drawings and plans. Unfortunately, "Building and Flying Indoor Model Airplanes" is long out of print and is rarely available for purchase, and when it does appear it is usually very expensive. Further, it is a bit dated since there have been considerable advances in modeling since it was published.

Lew Gitlow's "Indoor Flying Models" is also a must have for the serious indoor modeler. While not as well written as "Building and Flying Indoor Model Airplanes", "Indoor Flying Models" is more up to date and is still being published. It is available from hobby shops, via mail order from the NFFS, or directly from Indoor Model Supply.

Tim Goldstein has just released the new king of the hill, "Indoor News and Views Archive Collection 1962 - 2001". Imagine being able to access every issue of INAV from 1962 up to the present. All of the articles, reports, plans, and photographs are here.

"Indoor News and Views Archive Collection 1962 - 2001" is a CD with scanned images of every page of Indoor News and Views. The INAV Viewer is an easy to use program that lets you display and print individual pages of INAV.

A simple to use search function that allows searching the index by author, topic, and article type is part of the INAV Viewer. Unfortunately, the index has very few entries in it, but Tim hopes that as people use the INAV Viewer they will send him index entries which he will collect and redistribute. Adding index entries is easy to do.

Want to know when Paper Stick became Intermediate Stick, or what competitors thought about the last change to F1D? How about the winner of the 1968 World Championships? What did folks think of Tan II back in 1993? It's in here.

There are drawings and descriptions on building variable pitch propellers, rolled motorsticks and tailbooms. There are instructions on winding rubber, testing rubber, and test results of various batches of rubber. There are articles on microfilm and the latest thin mylar films. There are descriptions, drawings and photographs of variable diameter propellers. There is a description of how to make plug in tail booms.

There are plans and more plans. EZB, F1L, F1M, NOCAL, 35 cm, FROG, F1D, Cabin, Bostonian, mini-stick, Manhattan, HLG, CLG, scale stuff, and much more.

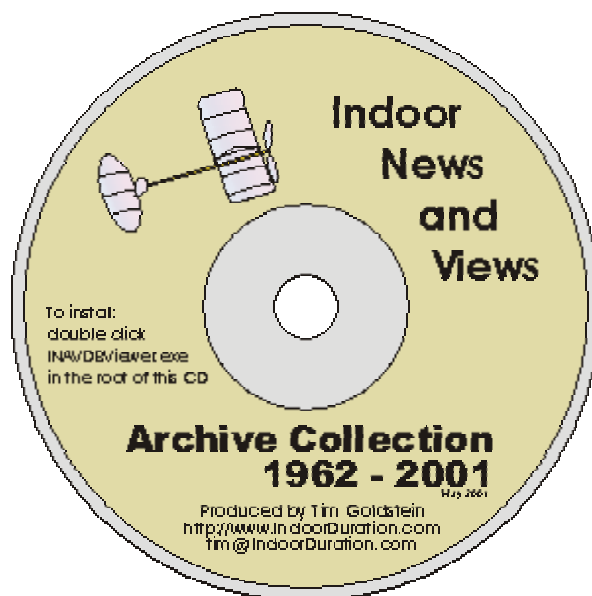
This CD is a real bargain. You won't regret buying it.

"Four Stars", "Two Thumbs Up", etc.

By **Mathew Chalker**

A new indoor Flier from the Science Olympiad program

The INAV archive is wonderful! All of the pages are in wonderful detail and very easily read. The program has a zoom feature, which is very helpful when trying to read various sizes of fonts and qualities. It also has a rotate feature so you can rotate any plans which are tilted for easier viewing of the plans. The archive also has a feature in which you can make you own index of the articles which can be a little time-consuming but once done saves tons of time. Tim mentioned something of a program to be able to share and mix indexes which will be posted to Tim's IndoorDuration website soon. The INAV archive is a great tool and reference material for anyone who flies indoor!



A TECHNICAL ANALYSIS OF RUBBER STRIP

By Carl Bakay

To start with a little background, I was working at Union Carbide Corporation in the 1960's as an organic R&D chemist at their Silicones plant in West Virginia. Although it was not my area, many of my friends were involved in the new field of synthetic silicone rubber, as were their counterparts at General Electric and Dow Chemical. The task was to make uniform batches of gum feedstock, and use it to make silicone elastomers for demanding environments such as aircraft window and door seals, engine o-rings, and the like. You have seen the gum sold in a slightly doctored form as Silly Putty, and it's also spread on paper as a non-stick backing for postage stamps and address labels everywhere.

Well, as you might expect, not only did the silicone gum come out of the extruder in a wide range of viscosities, but when blended with fillers and catalysts, the resulting rubber it produced had properties all over the scale. One batch of rubber would be outstanding, with everyone running around congratulating themselves, and then the next run would be so bad it would have to be burned. We liked to relate a similar tale of woe in the paper making industry. The paper mill made an outstanding roll of card stock for IBM cards, better in quality than any that had been made before, and the foreman wanted to know if he should ship it to the customer. The quality control guy said no, destroy it, because once IBM saw it they would want more of the same, and the paper mill could never make it that good again. Although my friends at Union Carbide worked on the problem for years, to this day, synthetic rubber manufacturing is more an art than a science. This is true even more so for natural rubber products.

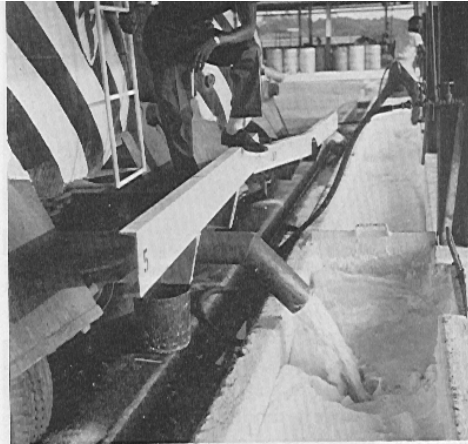
FROM SAP TO STRIPS

We rubber fliers find ourselves in an even worse predicament than the stories told above. Tan II is a natural rubber product that relies on tree sap as a raw starting ingredient. And as John Clapp said, like wine made from grapes, some years are better than others. As you will see, adding in the variable of manufacturing just compounds this problem (a little pun, that).

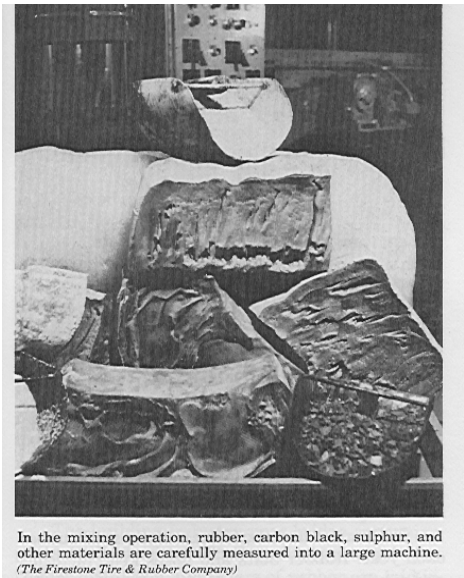
Most of today's natural rubber comes from the sap of the Hevea tree. Its bark contains a white milky fluid called latex, from the Latin lac, meaning milk. From the time the tree is six years old until it is about thirty-six, it can be counted on to produce about four to fifteen pounds of latex a year. As shown in the photos, this is collected from each tree in cups, and taken by truck to a processing plant. There it is mixed with acid causing it to curdle and separate into rubber and water.



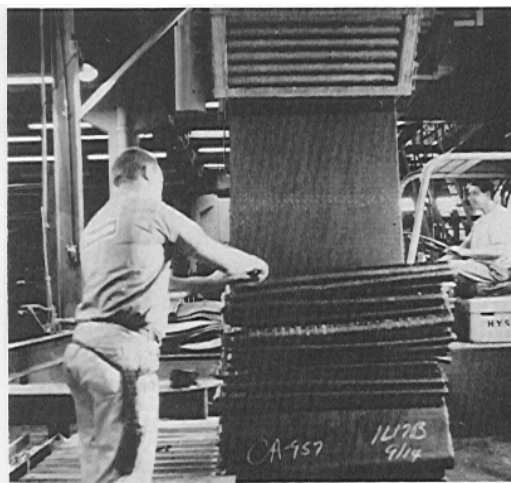
Rubber comes from a white sticky liquid found in the bark of the Hevea tree. (The Firestone Tire & Rubber Company)



Latex is taken from the field trucks to the processing plant by truck. (The Firestone Tire & Rubber Company)



In the mixing operation, rubber, carbon black, sulphur, and other materials are carefully measured into a large machine. (The Firestone Tire & Rubber Company)



After the final mixing, the rubber is rolled into a continuous sheet ready for further processing. (The Firestone Tire & Rubber Company)

This crude product is then squeezed, dried, and formed into bales for shipment all over the world. When a bale of rubber arrives at the manufacturing location, it is first opened and sliced into small pieces. It is again washed and dried to get rid of impurities, and heads to a compounding room. Here, strips of crude rubber are fed through rollers to soften the rubber. Here, too, vulcanizing agents such as sulfur and charcoal, accelerators, pigments, and antioxidants are added as specified by the laboratory.

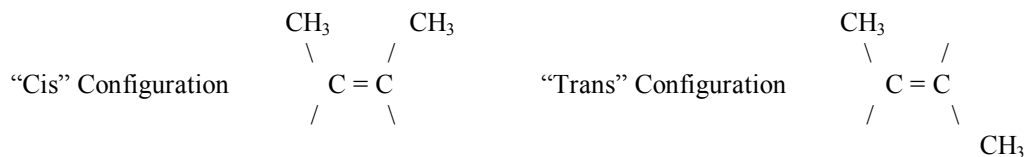
It is now combined with about an equal amount of reclaimed rubber, and fed into a Banbury mixer, which has grooved rollers and can do a better job of mixing than a smooth roller mill. At this point, it is still a crude, workable mixture, and what happens to it next depends on its end use. If it's going to be made into rubber bands, the mix is fed through an extruder which forms a rubber tube ten to twenty feet long. These tubes are then baked to vulcanize them, and sliced into circular rubber bands. If it's going to be made into rubber strip, it is warmed on a warming mill and passed through a calender, which has a series of rollers which can be adjusted to turn out a sheet of any thickness. For Tan II, it is calendered into sheets 0.021" thick, and two of these sheets are then pressed together and vulcanized to get a 0.042" thick finished rubber sheet. A more uniform product can be made in this way than by rolling one, thicker sheet. This is treated with talcum powder and fed through slitters to get Tan II rubber strip.

As far as size goes, this customer can testify that quality control is very good. FAI Supply says the thickness is 0.042 ± 0.005 ", and I've seen a range from 0.0415 to 0.0433 by measuring 6 to 8 strip stacks with a micrometer, which is considerably better than claimed. As for the width, my 1/8" strip samples are always exactly 0.125" with no discernible variation. However, I only have experience with 1998-2000 batches.

THE CHEMICAL SIDE OF RUBBER

Natural rubber is a unique material. It is malleable and can be extruded and molded like a liquid, yet it is elastic and retains its shape like a solid. What modelers are concerned with is its ability to absorb energy in the form of stretching and twisting, and then give back most of that energy in returning to its original shape. It is able to do this because rubber is a matrix of long polymer chains. "Poly" means many and "mer" means units, so these long chains are made up of many, repeating, units.

The monomer is called isoprene, and is made up of four carbon atoms, with what chemists call a "double bond" in the middle. On either side of this bond are two methyl, or CH_3 , groups, large and bulky.



As latex forms in the bark of the hevea tree, the monomer units join up to make a rubber polymer. The size of the molecules are determined during the growing season. Since the double bond holds the two central carbon atoms rigidly in a plane, the methyl groups can either be on the same side of the rubber chain (cis), or on opposite sides of the rubber chain (trans) as it forms. So, aside from the molecule size, or molecular weight, the cis-trans ratio is determined at this time. This is because the molecule is never all of one or the other, but a mixture of the two configurations.

This is not so important to us while the latex is in a watery solution, and the long chains are just floating about in a dissolved state. But as the latex is coagulated, dried, rolled, and generally beat to death, the molecules fold into an ordered, semisolid mass. If there is a high proportion of Cis units in the chains, the bulky methyl groups prevent folding, and the final vulcanized product will have one set of properties. If there is a higher proportion of Trans units, the chains are more flexible and can fold easily into a more ordered solid. This final product will have a different set of properties. What is known at this point is that the “cis-trans ratio” in rubber is very important in determining, and eventually predicting, its properties. What is also known is that a more highly folded solid will crystallize more easily, and then break under high stress.

THE ENGINEERING SIDE OF RUBBER

Engineers have long known of elasticity when measuring the strength of materials –it can be measured in the form of a stress-strain curve. An applied stress, or pulling, yields a resulting strain, or elongation and/or twisting. This is reversible, so all solids are elastic to a certain degree, until the stress exceeds the strength of the material, and it breaks. Vulcanized rubber is a tremendously strong material, but it doesn't give much warning of its yield point - it just breaks.

As shown in the sketch at right, in its relaxed state, the chains are folded and entwined around each other. They are also crosslinked, or joined to other chains by linkages in the sulfur atoms formed during the vulcanization (or heating) step in manufacturing. But when stretched, the coils unwind and absorb energy. If kept lined up at the right temperature for too long, crystallization and breakage can occur.

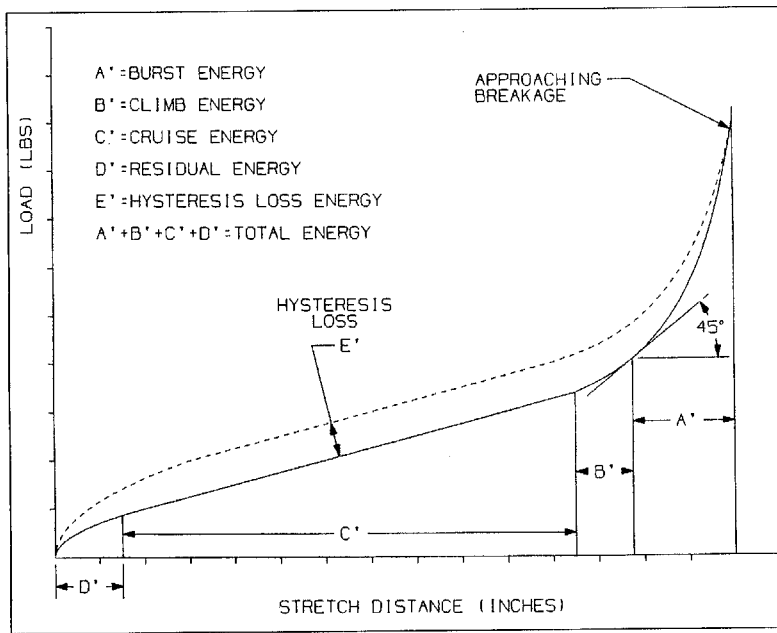


An important feature of a reversible stress-strain chart is that the stretching and relaxation curves don't lie on top of each other. In other words, you never get out what you put in. This is due to hysteresis, a French word meaning 'to fall short'. In the case of rubber, it is energy lost. Pull on a rubber band and press it to your skin; it will feel warm. This is stretch energy lost in the form of heat. Pull very hard on it and hold it for a long time, and it may turn brittle and snap. This is energy lost in forming brittle crystals and the failure of weak crosslinks in the rubber matrix.

FINDING THE ENERGY IN A RUBBER LOOP

All this leads us to the heart of this article, which is how and why rubber loops are tested for something called “total energy”, and what this means to the serious flier. The whole point of the introduction *From Sap to Strip* was to highlight all the variables inherent in making the box of rubber we buy and use. But, as a friend of mine asked, “Why all of this testing? Are we going to send it back?” No, I'm not, but I can accumulate many different batches, test them and see how others have tested them, and use the best to compete with and the rest for practice or sport flying. Also, Chilton and Tenny and Rash and Coslick will tell you that you have to wind a lot of samples and break a lot of motors to get good at it. Testing is a way to speed up that process.

The hysteresis stretch-strain energy curve for a rubber loop drawn by John Clapp is shown below. It should be familiar to most readers. It is dimensionless, in that it doesn't have actual numbers on the axes, but if it did, the best numbers to have would be 0 to 100% on both. That way all sizes and weights and batches can be drawn on the same plot, and only the differences between samples would show up.



Whether we are winding or stretching, the first step is to make up 5 to 10 identical loops from the same batch, weigh them, break them in if desired, and wind or pull a few until they snap. This will establish the 100% point on the x (horizontal) axis. Then we record force in either pounds pull every 3 inches, or inch-ounces of torque every 100 turns, up until 95 to 98% of the breaking point, and then record the same increments while relaxing or unwinding the strip. The difference between the two curves is the hysteresis loss due to friction heat, broken links and crystallization mentioned earlier. The area under the return (lower) curve is the useable energy of the rubber sample.

ENERGY FROM STRETCH TESTS

Let's take stretch testing first. If we divide the return energy curve into slices, or bars to denote the sample size, the calculation method to find the area becomes obvious. Merely add up the pieces to get the whole. We add these bars together into one long strip of forces, three inches wide. The actual amounts of pull recorded during the test are noted on the graph below as F values. We first sum the forces by totaling up the average heights of all the rectangles under the return energy curve. The average value is simply the force on one side plus the force on the other divided by two. So the sum of the forces looks like

$$F = (F_{max} + F_1)/2 + (F_1 + F_2)/2 + (F_2 + F_3)/2 + \dots$$

But this can be simplified. If we multiply through by 1/2, we get

$$F = \frac{1}{2}F_{max} + \frac{1}{2}F_1 + \frac{1}{2}F_1 + \frac{1}{2}F_2 + \frac{1}{2}F_2 + \frac{1}{2}F_3 + \frac{1}{2}F_3 + \dots$$

and combining like forces, gives

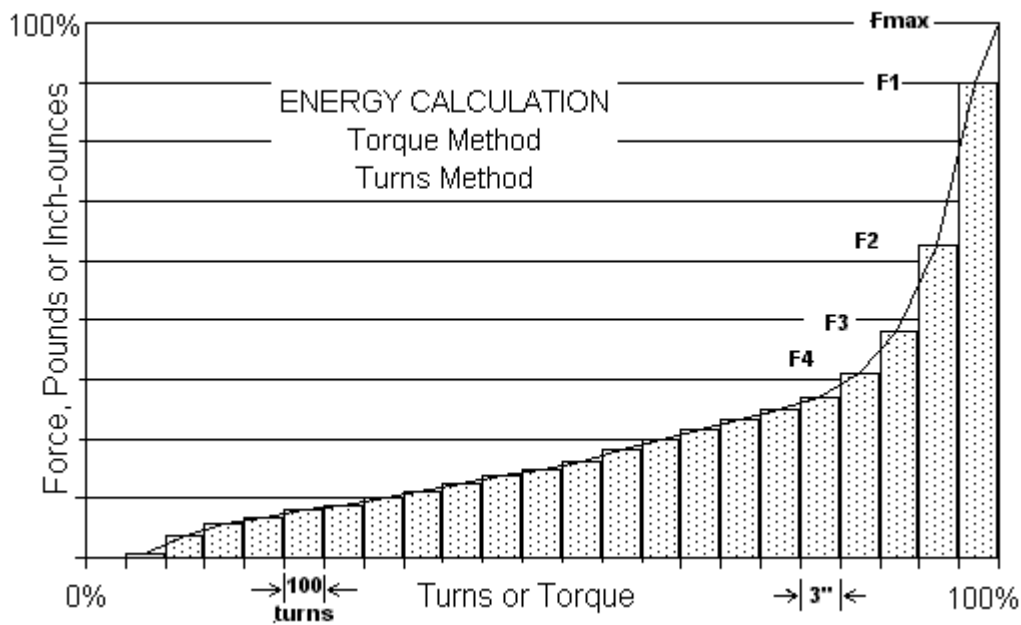
$$F = \frac{1}{2}F_{max} + F_1 + F_2 + F_3 + \dots$$

$$F = \frac{1}{2}F_{max} + \text{sum of all the remaining forces,}$$

(or the way Gibbs writes it, $(2\text{sum} + F_{max})/2$, which is the same thing).

The last step is to convert to foot-pounds/pound, using $\frac{1}{4}$ to change the 3-inches to feet, and 16 to change the strip weight in ounces to pounds.

$$\text{Energy} = \frac{1}{4} \times 16 F / Wt \text{ of strip in oz.} = 4F/Wt \text{ of strip in oz.}$$



ENERGY FROM TORQUE TESTS

The good news is that we don't have to go through the explanation of summing all the forces again, because finding the energy under a torque/turns curve is the same as for stretch. We are adding up strips that are T units high by 100 turns wide. Now we use T instead of F, so

$$T = \frac{1}{2}T_{max} + T_1 + T_2 + T_3 + \dots$$

$$T = \frac{1}{2}T_{max} + \text{sum of all the remaining Torques.}$$

We have angular energy being measured, so multiplying by 2π converts this to linear, there are 100 turns and 12 inch-pounds to the foot-pound, so the final equation needed is

$$E = 100 \times 2\pi \times T / (12 \times \text{Loop wt in oz}) = 52.35 \times T / \text{Loop wt. in oz.}$$

The last question to be asked when talking about measuring rubber energy is, "How do these two methods compare, and are the results meaningful?" The answer is, "It depends." Mathematically, the two analyses are the same, in that they accurately find the area under each curve, whether it be stretch or torque. But the following variables enter in to the test findings:

- Are tests adjusted for the same temperature?
- Are the samples from the same batch? The same box?
- Were the loops broken-in before testing?
- Was winding done by turns or by torque?
- Was the winding slow or fast?
- How close to the breaking point limit were the samples stressed?
- Was a lubricant used?
- Were enough samples tested to get a good average?

Without some examples, the usefulness of energy testing will be debated forever, but as background for this article, the table of energies below was assembled. It not only includes stretch and winding results, but also rerun values that show that all samples benefit from a breaking-in of some sort. To get some idea of the range in values, ordinary office rubber bands have an energy of 1800, and a steel spring an energy of about 8100 ft-lbs/lb. Readers are asked to search their files, and help INAV expand even further on this list.

RUBBER TEST ENERGIES – 1976 to 2000

Type	Batch	E @ 75°	Type	Batch	E @ 70°	Type	Batch	E @ 70°
FAI	2/76	3400-3500	Tan I	11/91	3596 ft-lb/lb	Tan II	9/00	4014
FAI	3/77	3200-3500	Tan II	5/94	3475		Rerun	4277
FAI	6/77	2700-3300	Tan II	6/94	4100+	Tan II	4/01	4172
FAI	11/77	3050	Tan II	8/94	4100+		Rerun	4327
FAI	9/78	3020	Tan II	4/95	3497			
FAI	2/79	3350	Tan II	1/96	4042			
FAI	6/79	3360	Tan II	4/96	4272			
FAI	11/79	3290-3500	Tan II	6/96	4137			
	Rerun	3370-3600	Tan II	7/97	3580-4140			
Pirelli	1978	3910	Tan II	10/97	4513			
Pirelli	1978	3680	Tan II	2/98	4485			
Pirelli	4/79	3500	Tan II	5/98	4042-4325			
Pirelli	6/79	3700	Tan II	7/98	3942-4390			
Pirelli	9/79	3430-3615	Tan II	2/99	4582			
	Rerun	3600-3720	Tan II	3/99	4198			
FAI Tan	1991	3770-4100	Tan II	5/99	4110-4675			
FAI Tan	1990	3050-3120	Tan II	7/99	4093-4215			

BRINGING IT ALL TOGETHER

Some technical types I know are in love with data; lots and lots of data. But the real value comes when this is organized into information that the reader can use. Two modelers who have shown the way in turning energy testing into contest performance are Lt Col. Bob Randolph of F1D fame, and Wakefield flier Jim O'Reilly. In his short article in April 1993 INAV, Randolph states:

“Suddenly the idea hit me that what makes F1D so great is that everything is important. You need a good design, a well built model, a well adjusted model, good rubber, and capability to find the optimum motor to obtain really long flights. Any one factor that doesn't measure up will reduce duration. Therefore your goal should be to improve all of the skills required. Some may question what skill has to do with rubber. The skill is in being able to identify which of the rubber you possess is the best and to keep an active lookout for better.”

Since 1983, Randolph has been using quarter motors in practice, and using his best quality, full motors for contest day. This way he stays with the best batch, and conserves what he has at the same time.

Jim O'Reilly has taken this a step further and has outlined a system of integrated testing and flying. This means that his stretch testing is done on actual contest motors, not samples from the box they came in, and this both breaks in and sorts the motors by specific energy. Although developed for outdoor, it is just as applicable to indoor.

1. Make up motors to weight and length and put motors and labels in plastic bags.
2. Lube motors and check their lubed weights.
3. Conduct pull-type energy and break-in tests.
4. Make a table of motors and their energies for the contest. Plan the best motors for early morning and flyoff rounds, with lesser motors for the warmer, thermal part of the day.
5. Wind to torque values on the torque vs. length chart. Finish winding very slowly.
6. Don't be afraid to re-use a motor if it has no broken strands or nicks.

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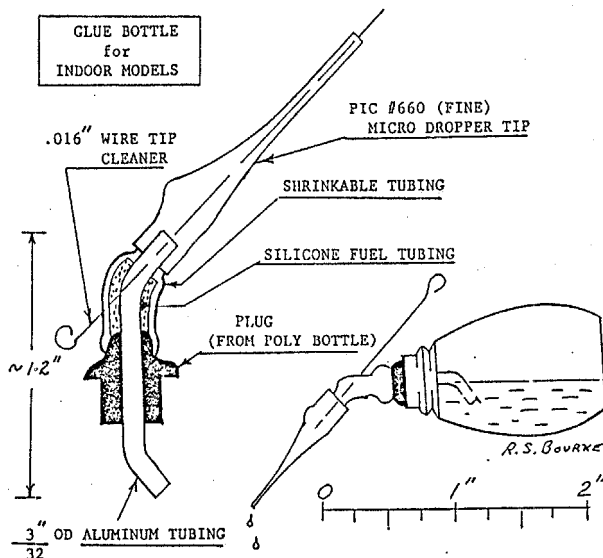
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A MICRO-DROP GLUE APPLICATOR FOR INDOOR MODELS

By Roy Bourke Markham Indoor Group

One of the secrets of building light indoor models is to pay attention to the glue joints. Excess glue is heavy, and does not necessarily add strength to the joint. A good glue applicator can go a long way to ensure the accurate placement of just the right amount of glue to each joint. The accompanying sketches show an excellent glue bottle that can be used with acetone-thinned model air-craft cement or water-thinned white glue or Titebond, as used on indoor models. incidentally, I did not design this glue bottle. It is available Commercially from the USA, but it is much cheaper to make one yourself.

The best poly-bottle to use is a small food colouring bottle (McCormacks food colouring), but there are several other poly bottles that could be used with minor modifications to the design. Begin by bending a piece of 3/32" aluminum tubing to the shape shown, and fit it to the plug that comes with the poly bottle that you are using. Make sure that you make the lower bend such that you can still insert the plug into the bottle without interference from the tubing.



Drill a small hole (0.016") in the upper bend for the wire tip cleaner, then cover the bend with a short piece of silicone fuel line. Add a piece of shrinkable tubing over the silicone tubing, shrink it in place, then add the Pic Micro-Dropper tip to the end of the aluminum tubing. Make up the wire tip cleaner, and insert it backwards through the nozzle to pierce a hole in the silicone end shrinkable tubings. Finally, re-insert the tip cleaner from the back end of the nozzle, and the glue bottle is complete.

To use the bottle, simply draw the wire tip cleaner back only far enough to clear the narrow part of the bore of the Pic nozzle, tip the bottle and squeeze. You will find you have excellent control of the amount of glue that appears the tip. During storage, the tip cleaner is left fully inserted to seal off the nozzle. Since polyethylene does allow some evaporation of the acetone, you should check the thickness of the glue periodically, and add acetone as necessary.

The Indoor group started by Don Slusarczyk is a tremendous resource and great way for indoor fliers to stay in touch. This group is free and can be read via a web browser or received as e-mails. To join from a web browser go to <http://groups.yahoo.com/group/indoor/join>

indoor-subscribe@yahoogroups.com

Mini Miter box

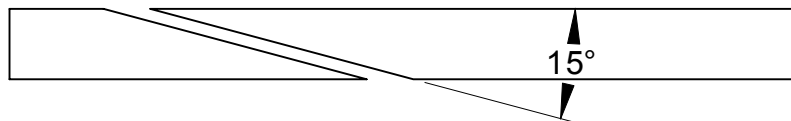
By Bruce Kimball

I originally designed the mini miter box to help improve the quality of my scarf joints that I use to join prop spars together. I was tired of cutting the spars to the correct taper for the prop and then screwing up by trimming too much away as I tried to get a perfect splice. I sometimes ended up with a spar that was too small and weak or in the worst case too short for the blade. None of the commercial miter boxes had a shallow enough angle to splice the length that I wanted.

I made the first one by gluing a piece of 3/8" square wood to a small base. I needed to cut a slot in it while keeping it at the correct angle. I also discovered that by using a razor saw to cut the slot you ended up with a slot that was too loose to guide the razor blade correctly. I wanted a tighter slot so that when I slid the razor blade down into it there would be no slop and the cut would be very precise. It finally dawned on me that it was easier to put the exact angle on two pieces of wood and then glue them into place with the correct space between them. The first version was fabricated out of some scrap walnut and was assembled with the new technique and it worked beautifully. The joints fit together so well that it is close to impossible to see the splice.

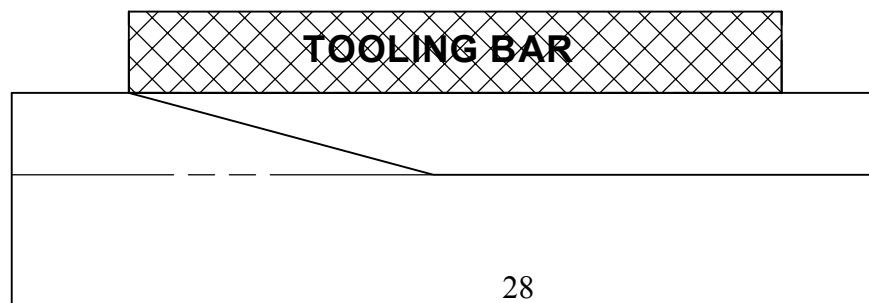
I made a few extra and brought them to the Kibbie Dome contest to give away as prizes. The versions that I have made have all been out of walnut just because it looks nice and is easy to work with. You can use whatever wood you want but the harder it is the longer it will last. The bases are made out of thin wood between 1/8 to 1/4" thick and the back pieces are out of 3/8" square. I suggest a small piece of 1/8" plywood for the base and some 3/8" square spruce for the back if you don't have any other wood in stock.

The dimensions are not too critical but I have found that this is a nice size that fits into your toolbox, for onsite repairs. Take your time and make sure everything is square, as it will affect the quality of the splice. Take the 3/8"sq and cut the 15-degree angle across the width using one of the Foremost Model Products mitersaws to give you an angled cut as shown in the following diagram.

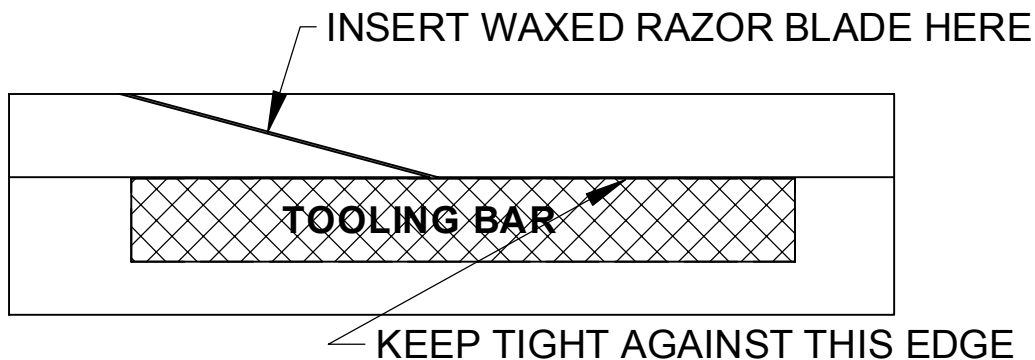


I sand the angle using the Foremost Model Products miter so it is smooth and both pieces are at the same angle. If you have a table saw and a disc sander then use them making sure that everything is accurate.

I glue the longer piece on the base first by using a straight edge to line up the edges. I use a 3/8" square tooling bar but you can use a scrap piece of the spruce, just make sure that it is straight. I use a very thin layer of 5-minute epoxy to glue the parts together. You can also use white glue or even CA if you prefer. It has to be very thin so it doesn't tip the 3/8" square when it is glued on. The part should look like the following figure.



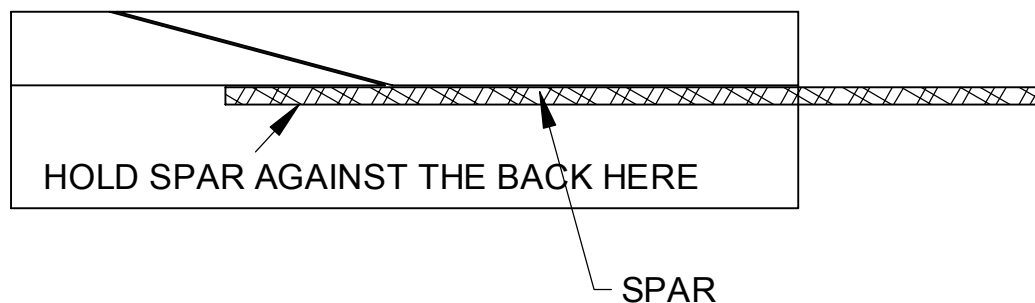
After it has cured then the next piece is glued onto the base. The secret of the tight fit on the razor blade is that you put a razor blade in between the two pieces when you glue the second piece on. I put the tooling bar (or straight piece of spruce) on the lower edge of the 3/8" square as the next drawing shows and put the waxed (to prevent it from being glued in) razor blade next to the angled edge of the back piece. I put the next angled back piece against the razor blade and wedge it in place by pushing it into the blade while keeping the tooling bar in place. You can use a clamp to hold the tooling bar tight to the back piece, which will prevent it from moving.



After the glue dries, remove the tooling bar and clean out any excess glue that may have dried between the base and the back piece. You want that corner to be square so that the spars fit tight up against the back. Give the entire miter box a light sanding to clean off excess glue and to also give it a nice appearance. I also chamfer the edges so the balsa will not crease on a sharp edge while being held in place. Check the fit of the razor blade to see how snug it fits. You want it to be tight so the blade will not tilt and give you a crooked cut.

When I cut the splices, I hold the large end of the spar on the left side in place with my left index finger gently pressing it into the corner and then sliding the sharp blade down through the slot until it slices through the part. I usually push the blade down and into the back piece to shear the wood and help prevent the crushing from cutting straight down. Repeat for the other spar and when you are happy with the results glue them together using your favorite method.

You can also make different angles for different splices using the same technique or even 90 degrees for square cuts. I have completed some boxes with the angle on one end and a 90-degree slot on the other end. I hope that you give one of these tools a try, I think you will be impressed how nice they work



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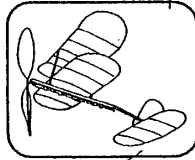
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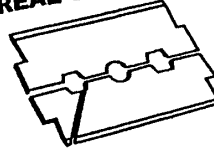
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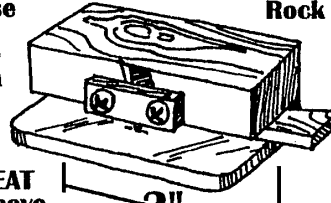
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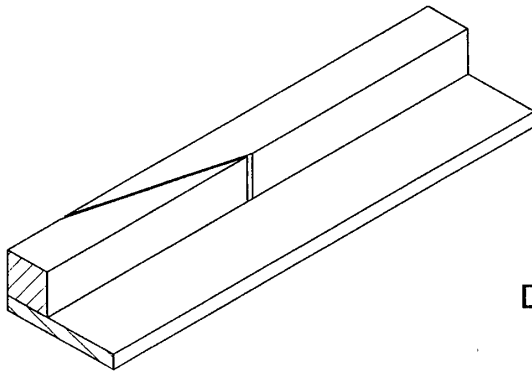
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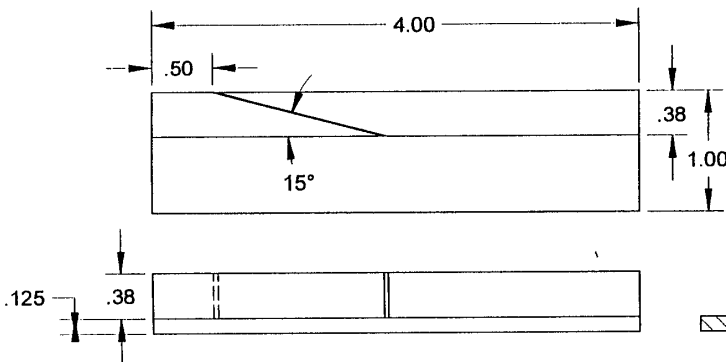
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Mini Miter Box

Design and Drawn by Bruce Kimball



KNOTS

All of us who fly rubber powered models are faced with the same dilemma. Connecting the ends of a strip of rubber into a loop, or, the infamous knot. Here we present three different knots, with some pros & cons of each.

#1. The Classic Knot. This knot has been used for years. It works quite well, except that it tends to come untied, especially with really slippery lubes. Also, it is heavier than any of the other knots presented here. An added problem is that due to it's large size, it can rotate around and punch holes through your motor sticks. Just such an incident caused me to look seriously at other knots.

#2. The Thread knot. In a recent article I referred to this as a "Richmond style" knot. That's because Jim Richmond taught me how to tie this knot in 1982. I don't know who originated this knot, but it has been around for many years. It is favored by many because of it's light weight (.0005 -.0007 ounces). I used it for many years, but I ran into occasional problems with breakage at the knot.

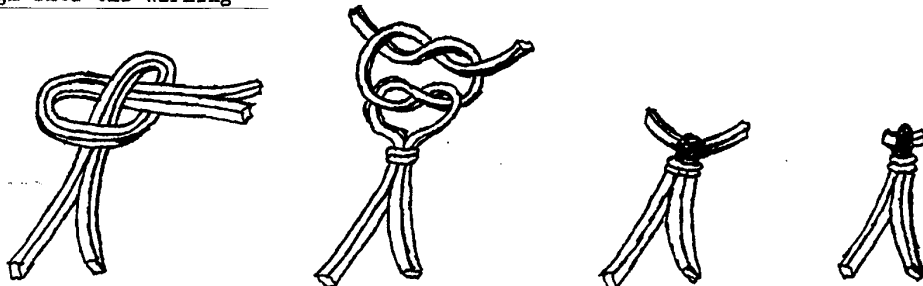
After some careful observation, I realized that the rubber was actually sliding right through the thread, and when the glued section of the rubber slid through into the working

part of the rubber, BANG! The rubber broke. When I began experimenting with alternate lubes, like Armor-All, the problem got worse.

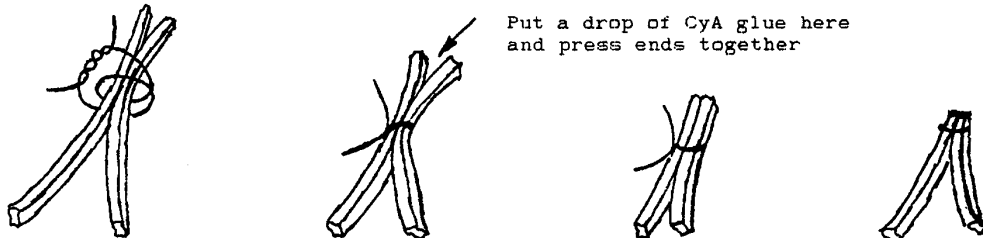
The breakage peaked out when I bought a force gage and began to stretch test rubber. I found that this type of knot consistently came apart at about 3.6 to 3.8 pounds of stretch. Yet the Pierce formulas called for stretch up to about 4.7 pounds to test these particular samples. This is when I watched the knots carefully and discovered the slippage. After some experimenting, I came up with the modified knot as shown in #3.

#3 Modified Classic Knot. The basic problem with the Thread knot, is that the wrap of thread is static, and doesn't tighten up as the rubber is stretched. Both the Classic knot and the Modified knot have a wrap of rubber that stretches and tightens as the motor is stretched. The key to the Modified knot is that the CyA glue secures the backup knot into a shape like a bow-tie, so the backup knot can't slip through the wrap. This knot will take in excess of 5.0 pounds of stretch when tied in the same loops of rubber that broke the thread knots at 3.6 to 3.8 pounds. This knot is definitely stronger. My samples of the Modified Classic knot weighed between .0008 and .0009 ounces, which is a very small weight penalty when compared to the Thread knot.

THE CLASSIC KNOT

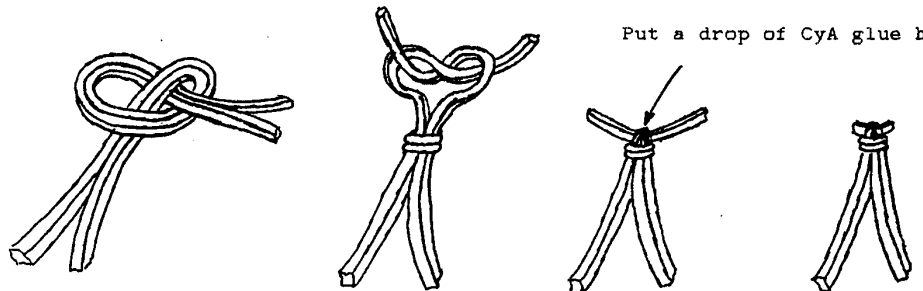


THE THREAD KNOT



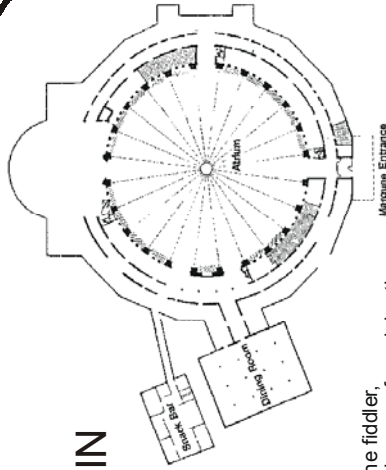
Put a drop of CyA glue here and press ends together

THE MODIFIED CLASSIC KNOT



Put a drop of CyA glue here

West Baden, IN



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Other Questions call Walt Van Gorder at 513-922-3351 between 6:30 - 9:30 pm.