From the Membership Desk:

Another 2 months have passed by and I still am as behind on projects as ever. Progress is being made on a number of fronts and some that involve INAV.

First up I need to announce a rate increase for INAV. This increase is effective immediately and any subscriptions or renewals received at the old rate will be prorated based on the new rate. There are a number of reasons we need to have this increase. The primary reason is that our printing costs have increased. For the past year I have been able to print INAV for only the cost of the paper. With an upgrade in the printer I was using the machine has a new contract and we now have to pay a per page fee. While it is still a sweetheart deal and about 1/6 the cost of having them printed at a commercial shop it is still an increase in our costs. We are also anticipating a postal rate increase in the next few months and need to have the funds available to cover this cost increase. Finally at the current rate we are stretched putting out 5 issues per year. The increase will give us the funding to not only cover the increased expenses, but also fund a 6th issue this year. Considering the quality and content that Carl has helped me get into INAV I feel that even at the new rate this newsletter is still a bargain and I expect that your continued support will confirm this.

One of the items of progress to note is that through the generosity of Jerry Murphy of Colorado Springs I have been able to fill a few more holes in the INAV archive. Jerry was able to provide a number of issues from 1961 and even one issue from 1960. He also provided a couple that were missing from 1969 and 1970. I am still searching for a few issues that Jerry did not have from 1960 & 61. If you have any issues from those years please let me know so they can be scanned for the archive to preserve them for the future. I will be releasing an update to the archive later this year that will include the additional back issues and the recent issues that were published after the archive was created. Time frame is likely to be late fall or early winter. Existing archive owners will be able to get the update for a nominal charge to cover the media and postage.

We are continuing to pursue ways to increase awareness of INAV and increase the subscriber base. One avenue that is yielding results is a promo flier. Ray Harlan, Y2K Film, Specialized Balsa Wood, Jim Jones, and Geauga Precision Models are putting this flier in with orders to help spread the word about INAV. To enable current subscribers to help I have put an Adobe Acrobat,.pdf file of the flier on my website. You will find the link to it on the top of the INAV page on http://www.IndoorDuration.com Print it and pass them out. I am still amazed that after 40+ years of publication many people don’t know INAV exists. The fact that we are back stronger than ever is also news to some. Another avenue we are just starting to explore is trying to get INAV sold in hobby shops. To that end we have added a per issue price on the front cover. The next step is to contact some local shops and see if they will add INAV to their newsrack. If you are friendly with a shop that may be willing let me know and I will pass along the details on this program.

The rush of the contest season is almost upon us. I will be flying at Lakehurst over the Memorial day weekend and at the Kibbie Dome event. I hope to see some of you there. Off to cut some wood and get some new planes built.

Tim

---

**PPP Film (Penny Plane Plastic)**
1025 Cedar St
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.7 micron film that is economical and easy to apply.
12" x 50’ rolls
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---

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Junior subscriptions are subsidized by the sale of the INAV archive CD and the donations of members. They are only available to those 18 or younger. To get a Junior rate, proof of age must be supplied with the subscription payment. Valid proof would include copies of high school or lower ID card, government issued permit, license, or ID with birthdate, Flying organization ID card showing non-adult status, or anything you feel proves your eligibility.

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**Contributing Editors:** Steve Gardner, U.S.A., Nick Aikman, U.K.

Can't get enough of Indoor News And Views? Then get the INAV Archive CD. This CD includes over 250 complete issues of INAV along with a custom viewer program that allows you to print all the issues, articles, and plans. Order your Archive CD today by sending US$45.00 plus shipping (USA US$3.00 all others US$5.00) to Tim Goldstein at the above address. Proceeds from the Archive CD go to support Junior indoor flying.

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.

**Simple Scale**

Jim Richmond submitted the scale design shown below, which was patterned after ones used by the Czech team at the 1968 World Champs in Rome. Although this is not a new idea, it bears repeating. This type of scale is as accurate as you make it (typical with most indoor scales) and indefinitely repeatable to that same accuracy. It is also capable of being packed in small spaces and rugged enough to be on the dependable in the flying site - which can't be said of most scale designs. Note that this design has a "mirror scale" similar to precision laboratory meters; this is done by using metallized mylar tape adjacent to the scale. In practice, you align your eye so the pointer appears to cover its reflection in the "mirror", and thus errors due to parallax are eliminated. If you are really finicky about weights, make a second spring for the other side of the scale, using smaller wire. For example, .008" diameter wire would be about 4 times as sensitive (full scale deflection of .3 grams), and would permit greater accuracy in weighing lighter parts.

![Simple Scale diagram](image-url)
REMEMBERING MIAMA FOUNDER DOC MARTIN
by Dave VTO Linstrum

On January 12, Doc Martin (after a battle with cancer) left his beloved Earthly flying sites to spiral up and fly with the angels near the ceiling. He is survived by son Matthew and daughter Lilah plus 3 lovely granddaughters.

Doc was born in 1927 in Philly, living as a youth near the Fred Megow kit factory. He built Dime Scale models when they were only a dime, starting a lifetime love affair with free flight. He earned a DDS at Penn School of Dental Medicine and established a dental practice in Coconut Grove (Miami) in 1953 continuing thru 2001.

He founded the Miami Indoor Aircraft Model Association in 1973 as a means to organize local flyers in competition. He found local flying sites such as the Opa Locka Blimp Hangar (a WW II structure) and various college gyms. Later his site search expanded to locations in Tampa Bay like MacDill AFB, Delta Air Hangar Tampa Airport, US Coast Guard St. Petersburg, and the huge Tropicana Dome (231 ft ceiling) in downtown St. Pete. He had hoped to fly at the 3rd Annual MIAMA meet there.

Monthly MIAMA contests were held at all those sites from Sept to May, with a wide variety of AMA & Flying Aces events. Doc was the sole Scale Judge.

Thirty-one years ago, he began publication of the monthly newsletter THE HANGAR PILOT to advise club members of upcoming meets, give results, and educate them about indoor flying. He prided himself on having a building plan in EVERY issue. His final effort #216 had a Tom Swift Red Cloud Airship on the cover and a Peanut Scale Polish PWS-11 by maestro Pres Bruning. There was also scale data for the Swiss Comte AC4 Gentleman- an excellent scale subject. The newsletter was a clear expression of his feelings, with often pungent remarks and educational items.

Doc's first love was Pistachio Scale, which he instituted as a USIC Event and an annual Postal Meet the MIAMA INTERGNATS. At first he invited flyers to mail their models to him- he recruited clubsters to proxy fly them. Lately he tried a postal meet format, with modelers flying at home and simply sending in their times. He built his own Pistachios, winning often. His favorite Goldwing canard homebuilt will be proposed as a donation to the AMA Museum in Muncie. It is a USIC winner.

I first met Doc at the 1972 AMA Indoor Nats at the Madison St Armory, Chicago. He had a group of Martin MO-1 in bright silver & chrome yellow US Navy livery. They flew like homesick angels. He then attended all the Nats, and was at the 1980 Indoor World Champs West Baden IN. He also flew at that site at various Record Trials.

I had the pleasure of being Doc's travel companion often, first to the 1978 F1D World Champs at Cardington Airship Shed UK. Bud Romak took home the trophy then. We shared many motel and ETSU dorm rooms, most recently at the 2001 USIC.

Doc was always a great dinner companion, with an opinion on everything-especially politics. He had a dry sense of humor-perhaps due to his being an Anglophile. He often flew at Old Warden and Middle Wallop FAC/SAM meets in the UK, then continued to the Edinburgh Jazz Festival. Dixieland Jazz was a passion. He often built models while listening. He built quickly but well on a desk in his 2nd story den in the live oaks.

His service to the AMA was as MIAMA President and Indoor Contest Board member. He earned the AMA Distinguished Service Award from VP Jim McNeill and the Blue Max medal of the Flying Aces club. His shop was filled with models and trophies.

For the story of Doc's Hangar Pilot publication, see the article in the Jan 1996 NFFS Digest. There is a good photo of him with his beloved Goldwing in FAC and Pistachio sizes. He is wearing surgery scrubs- his favorite comfy flying costume.

All who knew Doc saw him as a free spirit. His contributions to free flight were myriad and the MIAMA club will never be the same. He was our guiding light.
Tan II update
===============
Author: faimodelsupply@cyber-quest.com

It turned out that the first trial batch of Tan II at the new factory location was a very good product. The output of the first run was quite small as most of the rubber was scrapped during the run. This problem was due to a difference in geometry of the transfer equipment at one rolling mill in the production process and nothing to do with the polymer chemistry or curing of our product. We met with the factory production team and reviewed possible "fixes" to this situation. The end result is that a new trial batch of 1/8" has been scheduled for delivery to us by February 27th, and test results should be available by approximately March 4th.

As a result of this meeting, the factory has asked us (and our customers) to consider changing the thickness spec to .030" instead of .042". Factory QC as well as the Production Manager feel that this thickness change would allow them to do a better job producing Tan II. ALL AGREED THAT A THICKNESS CHANGE WILL NOT BE MADE UNTIL TESTS CAN BE RUN ON SAMPLE STRIPS BY A FEW MODELERS.

And received March 2, 2002

A new 1/8" test run due to be received by FAI late next week. If that run goes well, a large batch of all sizes will be received in about 45 days. We are also planning to have "sport rubber" for the non contest fliers for less cost. We are coming out with TAN SPORT! First batch due in with Tan II about the end of this week. First batch of both will be 1/8", if all goes well next batch will have 1/4" Sport plus all other sizes of Tan II. TAN SPORT will be much lower in cost

Thanks, John

Ode to F1D Indoor Model
by Warren Williams

Please no sneezes, my Indoor Gossamer flying on delicate breezes,
go drifting and still lifting. Up, up and away as if if to stay,
freezes for a second or more - shut the door!
Some think it's boring when we go soaring,
but how shall the hanger be when we pass the center Free
and into the open reams of meaning beams.
Oh Lord, bring on the balloon, so I can play a tune and guide my drifted gifted
from the floor and out of danger evermore.
It don't break the speed of sound but it does go around hoping
it's caught in time to center, yes, it's a contender and is better now
as the watches keep ticking, WOW!, who's kicking.
I'm still peaking above the catwalk, while I slowly walk amazed at the prop
as it fly, aloft in it's low pitch phase.
My time is rich, better than a 40 hitch, let it be 50, I won't change tho pitch.
My effort has paid off, as I trade off tough -
My plane is down, unwound, checking the time of this rhyme,
am I a 50 minute buff? Enough, Enough.
UPCOMING CONTESTS FOR 2002

GEORGIA – ATLANTA
April 27    Peach State Indoor Champs – North Springs High School – all events as above
            CD David Mills 404-350-9438
May 18     TTOMA Indoor Meet – North Springs High School, I-285 & Roswell Rd., Atlanta, GA
            all AMA events, A-6, S.O., No Cal, Hangar Rat. CD Gary Baughman 770-419-0416

IDAHO – MOSCOW
July 27 – 30  Kibbie Dome Indoor. A 4-day contest with the Wally Miller EZB contest (1.2 gm) flown in the middle of
            the main event. All AMA and FAI events flown. This is a world class 145' ceiling site. An FAC contest
            will be held at the same time. CD Andy Tagliafico at 503-452-0546

ILLINOIS – CHAMPAIGN
April 13, 14  2002 Midwestern State Indoor Championships. Sponsored by the Chicago Aeronuts. To
            be flown at the University of Illinois Armory, a great Cat III site. $20 entry fee if done by mail by April 1,
            $25 if done on site, $1 for juniors and Seniors. If you'd like an entry form mailed to you please contact
            Bob Warmann by phone or mail or Geoff Bower by email at gbower@uiuc.edu

MASSACHUSETTS – CAMBRIDGE
Evening Indoor at MIT –Flying from 6 pm to 10 pm at MIT’s Duport Gym, the corner of Vassar and Massachusetts Ave.
            in Cambridge, Mass. Call Ray Harlan at 508-358-4013. March 2, April 6, May 4

MICHIGAN – FLINT
May 5, 2002  Eighth Annual Spring Fling with 20 events, including Science Olympiad with mass launch. AMA and
            FAC events. Everything from catapult glider to F1D. Site: Inside Swing Golf Dome, Burton, Michigan.
            CD George Lewis, 3602 St. Clair Hwy, China Twp., MI 48054. 810-329-6833.

MICHIGAN – STERLING HTS
Heritage Jr. High School, 37400 Dodge Park Road (Corner of 16 Mile) Sterling
            Heights, Michigan 48312 Friday evenings 7:30 - 10 p.m. For info: Don Lang 586-751-3281
            April 12       Contest night -- Limited Penny Plane -- A 6 - No Cal - Mini Stick
            April 26       Contest night -- Jetco,Blatter, FAC Peanut Scale, Rubber Speed, Handlaunch , Standard Catapult

NEW YORK – ROCHESTER
Rochester Indoor Flyers have indoor flying sessions on alternate Sundays from 12 til 5 pm at the New Covenant
            Fellowship, 2070 Five Mile Line Road, Penfield, NY. Currently scheduled Sundays are 3/3, 3/17, 4/7, and 4/21. Contact
            Bob Clemens, WNYFFS President at robert.clemens@worldnet.att.net for details.

NEW JERSEY – LAKEHURST
Indoor Flying at Lakehurst – The East Coast Indoor Modelers (ECIM) have the use of Hangar
            #1 every week from sunup to sundown. The hangar is 800 ft. long by 250 ft., and 180 ft. high. To join ECIM.
            Contact Rob Romash at 856-985-6849. E-mail cgrain1@yahoo.com . Dues are $15 a year with a current AMA card.
            Must be a member of the ECIM with your membership card to gain access to the site due to new security policy.
            Contests held on Memorial Day weekend, July 4 weekend, and Labor Day weekend.

OHIO – KENT
April 7, 2002  6th Annual Indoor Contest at the Kent State U. field house, located ca. 30 miles southeast of Cleveland.
            Sponsored by the Cleveland Free Flight Society. Cat. III site. AMA events include standard catapult
            glider, EZB, LPP, ministick, and 7 g. Bostonian. Also 10 FAC events and an SO event. Entry fee is
            $25.00 at the door. Contest CD's are:
            Michael Zand                                        Larry Mzik
            5803 East Ash Road, Independence, OH 44131          117 Sycamore Drive, Painsville, OH 44077
            216-524-3480 imzand@hotmail.com                     440-357-7361

TENNESSEE – JOHNSON CITY
May 30 – June 3  AMA/NFFS Indoor Nationals, Johnson City, TN. Flying is in the MiniDome fieldhouse of East
            Tennessee State University. CD Abram Van Dover. 112 Tillerson Dr., Newport News, VA 23602
WASHINGTON - SEATTLE
The Boeing Employees Free Flight Model Flying Club (Hawks) have published their Northwest Indoor Flying Schedule. Events alternate between the Everett and Oxbow Recreation centers at the Boeing plant. Contact Keith Varnau in Seattle, WA at 425-717-5669 or 425-885-2335 evenings.

INTERNATIONAL CONTEST CALENDER
Courtesy of Gert Brendel,
Indoor Flight International

<table>
<thead>
<tr>
<th>Contest</th>
<th>Date</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgrade Cup F1D</td>
<td>25-26.5.02</td>
<td>Belgrad, Yugoslavia</td>
<td>Entry fee US$30. Contact: Vojislav Stojkovic, St. Kralja Petra 70, 11000 Beograd, Yugoslavia Tel: +38 111 18 96 27, fax: +38 111 18 64 43, email: <a href="mailto:l.s.d.@Eunet.yu">l.s.d.@Eunet.yu</a></td>
</tr>
<tr>
<td>Concours International</td>
<td>22-23.6.02</td>
<td>Orleans, France</td>
<td>F1D, F1L, F1M. Entry fee EUR 15.- 1 model, EUR 8.- next model. Contact Jacques Delcroix, 41, Allee du Coudray, 45160 Olivet, France Tel: +33 2 38 63 49 57, fax: +33 2 38 63 49 57</td>
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<tr>
<td>3rd Concours International</td>
<td>29-30.6.02</td>
<td>Bordeaux, France</td>
<td>F1D, F1L, F1M . Entry fee EUR 16.- 1 model, EUR 8.- next model. Contact: Jean-Pierre Darrouzes, 27, avenue Kennedy, 33600 Pessac, France Tel: +33 5 56 36 95 44</td>
</tr>
<tr>
<td>Interscale 2002</td>
<td>6-8.9.2002</td>
<td>Prostejov, Cz. Republic</td>
<td>Open Indoor Scale F/F. Contact: Ing. Tonda Alfery, email: <a href="mailto:astra@uhbrod.anet.cz">astra@uhbrod.anet.cz</a></td>
</tr>
</tbody>
</table>

INAV Jr F1D Team Fund Drive
Here are the supporters to date. We have all heard enough hot air about the junior problem. Now that we have some let’s do a better job of supporting them. Send your contribution to: Vern Hacker, 25599 Breckenridge Dr, Euclid OH 44117-1807 Make your checks payable to NFFS and mark INAV F1D Junior Fund in the memo.

<table>
<thead>
<tr>
<th>Amount Range</th>
<th>Supporters</th>
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<tbody>
<tr>
<td>Up to $49</td>
<td>Jack L Karn, Stuart Wecckerly, Steve Greibling, Douglas Oleson, Gordon Strickland, Bill Leppard, Jeff Aaron, Charles Stiles</td>
</tr>
<tr>
<td>$50 - $99</td>
<td>Czesar Banks, John Wereb, Vernon D. Hacker, Kermit Walker, Vern Neff, David Kazdan</td>
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<tr>
<td>$100 - $299</td>
<td>Gene Joshu, Lew Gitlow, Larry Loucka</td>
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<tr>
<td>$300 and up</td>
<td>INAV (from last team fund drive)</td>
</tr>
<tr>
<td>INAV Jr F1D</td>
<td>Hardy Broderson, Bob Stalick, Ken Spliller, Tim Goldstein, Larry Parsons</td>
</tr>
</tbody>
</table>
Poonker Notes:
By Rob Romash
CGrain1@yahoo.com

The Poonker arose from a need to get a ministick to the top of the hanger at Lakehurst. I needed a plane that could climb rapidly without the attendant stalling like the little minies usually do. Construction is typical depending on wood strength. My wing does have a tiny bit of flex on launch augmenting the adjustments built in. This ministick is an evolution of Joe Krush's K-777 which is always a consistent performer.

The prop was formed on a 2" dia. cylinder which is made from a thin deformable styrene, when the prop is put on about an 18 deg angle, I then deform the tube to give it a more radical shape: more twist is evident at the base of the prop rather then the tip. I also run a bit less pitch then is usual I am not sure how much, I use the looks-about-right method and am always tweaking depending on the mood of the aircraft. Walt Van Gorder says it looks pretty low.

I use a lot of space between the rubber and the motorstick so as to avoid hang ups. Be sure to have the wingtips very straight as to avoid any drag. Wingtips are covered on the inside using separate pieces of mylar this makes for a very clean transition at this joint. On launch it does a lot of flying on these tips. I adjust to conditions as I fly this thing so the plans show about what I had that day.

Conditions were in the low eighties and in the afternoon when the high time was set. You have to get a lucky day to do big times. There were several flights over 14 min with Poonker the same day but it wasn't until early afternoon that conditions became optimum. This ship runs on smallish rubber that has the living bejeezus wound out of it; for these flights, learning to wind until the next turn on your winder is the last is important, I also massage the knots before launch this helps a good deal with getting this rubber to unwind all the way.

Poonker works well in the hanger but I have trouble keeping it out of the ceiling at Johnson City. This is where I will tweak in more pitch and make it do some tricks before the climb. I think this design will work well for low ceiling with a bit more prop area and a bit more airfoil.

www.Indoorduration.com, Tim Goldstein's site, has an updated plan of Poonker with a bit more in the way of sizes and I encourage all to go get it. This ministick was named after my late cat Poonker who never would give a passing glance to my models flying around her head but would bring me a dead bird on a weekly basis, go figure. Any questions feel free to call me anytime 856 985 6849.

(Note: The photo is of my plane, not Rob’s – Carl the Editor)
THE POONKER MINISTICK

BY TZOB TROMASH

WING 7"  CHORD 2.5"

CAT IV RECORD
RUBBER MAY 99
.018 X 14"
4160 TURNS
NO BACKOFF
NO "O" RINGS
SPAR
.030 X .025

STAB 7"  CHORD 1.25"

.025 X .025

FLAT CENTER SECTION

.025 X .020

Wing tip스트로이 트 up

PROP 7"

.012 SHEET

.030 ROUND

FUSE 9.9"

2° DOWN TRUST 2° LEFT

1/6 INCIDENCE

MOTORSTIK 4.96"

1/6 WASH

WIN6 LEFT OFFSET 3/16

1/8 POLYHEDRAL

WING AND TAIL

1ST PLACE USIC 2001 12:37
WEIGHT .431 gM
COVERING POLYMICRO (WRINKLED)

CAT IV RECORD SEPT 1/01
LAKEHURST NJ
15:06

5° DOWM TRUST 2° LEFT
Note: This plan was accidentally left out of Issue 105, and is included here with our apologies.

Whoops! Carl sent it to me and I forgot to insert it into the print job. Tim

35 cm Model by Bob Bailey, 32.03 + 33.19, 1st Place at The Cargo Lifter Open International, 13-14 Oct. 01, Unofficial 36.23.
My original design was all Acrylic, but it could be made from Hard Balsa and Ply. The Pivot Pitch Arm, was riveted so it had a "stiff" action. I made the distance from hub centre to the pivot arm, 6 1/2" inches, for that is where most of the blade area will occur, on a typical F1D prop.

You can make this checker, larger or smaller, but the angles on the readout, will be different. Use the attached universal pitch graph, for the new angles. It could also be made from 1 piece, folded 16g Alum sheet 1, like the BZB version.

Small Rubber Band holds Prop shaft

File off Both outer Ends of bearing Hole to allow prop Shaft access (Harlan bearing or V-block)

Alternative 90° Readout (less compact)

Glue 1/8"x 3/8" balsa to outer face

Plan View Prop Spars

SideView

Drawn Full Size

Laurie Barr 3-7-02
The Super Sleuth

(Designed and constructed in 1997)

The dictionary describes a Sleuth as a casual detective. This is something most of us become when we decide to venture further into any of the categories this fine hobby has to offer. My past experiences with ezb had the usual progression of building other peoples models with some success but the frustration with trimming the high torque phase that all of us experience. I read all the news letters that I could get a hold of and then the article in January 1988 “Model Aviation” the “Serendipity” ezb was full of information on things that were never published with other designs in the past. This was a big boost to my progression. Other disciplines of the hobby were also helping to develop my thinking on good performance. For many years I followed R/C high tech glider development. These planes must be extremely efficient as their duration mostly depends on drag reduction. Things such as wing plan form are studied at length. The flying surfaces of this ezb are influenced by those theories in hopes of better flight performance.

In 1994 I was asked to C.D. our Canadian FAI team trials for Wakefield for the up coming world championships. This gave me the opportunity to talk with some of the top F1B flyers in the world. One of the topics we discussed was controlling the power burst phase of their impressive non variable incidence tail models. The thrust line passing through the C.G. was controlling the power burst. Reading of model aerodynamic books gave further insight to the importance of the position for the C.G. We must consider not only the longitudinal and lateral planes for it’s position but also it’s vertical position. When we can get the thrust line to pass through this vertical position it helps greatly to tame the tiger! The dropped tailboom helps to lower the mass associated with the tailboom and the stabilizer which in turn helps to lower the vertical position of the C.G. Another location of some mass is the wing and posts. Why put the wing high up on posts? This only raises the vertical position of the C.G. I have built many outdoor rubber models that had their wing position close to the fuselage and experienced no ill effects. The thrust line passes through the C.G. on this model. Did it work? The plane flew right off the board with very little trimming, just a small amount of sanding between the wing posts to adjust the washin. No sanding was done to the rear or front of the motor stick for down thrust or reduced incidence. For the 23:46 flight in our 80-foot ceiling, the plane was launched with .18 inch/ounce torque but I have launched as high as .25 inch/ounce without ill effect.

I have seen other inventive people using different configurations to achieve the same result but this layout seemed better and much simpler to construct. I am now testing a Ltd. Penny Plane of similar layout and it flies well with only minor trim adjustments also.

Barrie Taylor
This F1L was built just for the ‘Cargo lifter’ meeting. I used the best, stiffest wood that I could find. I have been using diagonal ribs for F1L wings and tailplanes for a long time; all the extra work is worthwhile as it gives good, rigid flying surfaces. It also has the added benefit of reducing the risk of folding a tailplane if you accidentally catch it during steering.

The thrust bearing is a shortened ‘Harlan’, set to give about 1.5 degrees of down-thrust and 3 degrees left side thrust. The extra side-thrust is needed to get up high in the unlimited ceiling at the German hanger. The wing is set up flat, with no warps at rest. The tailplane has about 1/16th washin and this is fine-tuned by twisting the rear of the boom in the tissue tube. Once set, it can be locked with a spot of glue. The rear tail post needs a small tissue wrap; the front tail post is inserted into the boom. The tip of the boom is raised ½ an inch and also offset ½ an inch to give left turn.

**Covering Procedure.**

Because I aimed to keep weight to a minimum and also wanted a nice, smooth covering, I decided to use Y2K film. First, I crumpled the film up quite tightly and then smoothed it out again on a large sheet of black mounting card. For this, I used a very soft blusher brush. The film was attached to a balsa frame using ‘Spraymount’ (the blue can variety). Generally when doing this, I try to get the covering quite tight and then I waft the whole frame up and down quite vigorously, without tearing the film. This helps to stretch out the wrinkles, leaving a uniformly smooth sheet of film with just enough slackness for covering. I leave the frame for a week or two, to reduce the static. I use the same ‘Spraymount’ as an adhesive and covering the wing requires two light passes, the tailplane only needs one. The components are then dropped upside down onto the film and cut out with a 15watt soldering iron. I make sure that the film is completely stuck to the outline, particularly at the dihedral ribs.

To set the dihedral on the wing and tail, I cut half way through the underside of the spars and crack up the wing tips and ‘fins’ on the tailplane. The joints are well glued and a tiny rectangle of balsa sheet is cemented across the dihedral break at front and back to add strength. The slack film at the joint is taken up by running a brush loaded with a very thin mixture of 1part ‘Duco’ cement and 10 parts acetone.

The original, full sized plan has been reduced to fit into INAV and must be enlarged again to build from. Raising the tips until the span is very fractionally less than 18 inches sets the dihedral angle on the wing.
LAURIE BARR’S BORON JIG
FOR MOTORSTICKS
AND TAILBOOMS

Cut the motorstick to the length required, and slide back over the form rod. Mark the position required for the boron around the circumference of the motorstick (see method below). Cut boron 1” longer than the M/S. Remove a fine hypodermic needle from a syringe and fill with Duco and acetone of clear dope consistency. Pass boron through mixture in the needle and hang up to dry.

Find some 0.040 to 0.060 rubber and tie a single know tight around boron near ends and cyano in place. Cut rubber 4” long and make a loop and cyano. Place form rod with M/S on the 2 wedges and allow to roll down slope, up to the two stops marked “X”.

Stretch the rubber bands and stick modeling pins into the 4” uprights at each end. Slide this up/down until the boron is resting on top of the motorstick. If needs be, wrap bands around the rear of the 4” uprights. Rotate the motorstick until the boron sits over the mark made before, where you want the Boron to be.

Using a medium-sized brush, apply acetone, starting from the right end (for right-handers!) and wet approx. 2” at a time, and press the boron down hard, using the metal end of the brush holding the hairs.

Remove the rubber, and rotate the M/S to the next position. When all 4 are done, remove from jig and snap off the over-length ends of boron. Do this over a white sheet of paper to allow you to see any shards. Apply stick tape to any shards, fold and dispose. Re-stich the loose ends of boron.

Allow 10 minutes ? to set, and slide the M/S off the rod, and lightly holding each end, bow the middle away from you. Any boron not attached will show as a kink. Re-glue as required.

This jig can be made in minutes. The boron will be dead straight, under modest tension, no boron will be loose, and it is done for the least weight.
LAURIE BARR'S BORON JIG
FOR MOTORSTICKS
AND TAILBOOMS
5 FEB 2002

1/2" x 1/8" x 4" BALSA
EACH END ALLOWS POSITION
(HEIGHT) OF BORON TO BE
ADJUSTED VIA PINS

0.004" BORON
GRANITY HOLDS

PRE-MARK EXACT LOCATION OF 0.004" BORON.
WRAP A THIN STRIP OF A "POST-IT" NOTE
AROUND THE CIRCUMFERENCE, STICKY
SIDE DOWN. CUT, FOLD IN TWO, THEN FOLD
AGAIN IN FOUR. LINE UP THESE MARKS WHERE
YOU WANT THE BORON AND "DOT" MARK
LOCATION ON THE MOTORSTICK.
NON BERNOULLIAN AERODYNAMICS FOR INDOOR MODELS

Vernon D. Neff
vdneff@aol.com

I am quite new at indoor flying but very much fascinated by this hobby/science. I have been particularly intrigued by the often heard comments about the breakdown of the Bernoulli principle at very low flying speeds where we still make models fly for long times under low power. As we all know these conditions are estimated in terms of the Reynolds number (Re) which provides a measure for good (streamlined) flow over and under a flying surface. At very low flight speed the flow may become almost completely detached from the surface and wander into some never never land without producing much lift. The extent of this flow problem can be rather dramatically illustrated by considering a simple example of an actual indoor model which, for simplicity, we choose to be a (1.2 g) EZB designed with a flat (non cambered) wing. A further reasonable assumption is that the EZB flies at a speed of about 1 meter/second and that all of the lift is produced by the wing. Under these conditions the Reynolds number (Re) for tangential flow over and under the surface of the wing is about 5000 (in SI units). We need to write down the standard Bernoulli equations for lift and drag which are valid when both lift and drag are produced entirely by the Bernoulli effect. As is well known these equations are:

\[ L = \frac{1}{2} \rho A v^2 C_l \]  
\[ D = \frac{1}{2} \rho A v^2 C_d \]

where \( \rho \) is the density of air, \( A \) is the total surface area of the wing, and \( v \) is the velocity with which the air flows tangentially over and under the wing. The lift and drag coefficients, \( C_l \) and \( C_d \), are determined experimentally from actual measurements of lift and drag in the wind tunnel. Such experiments have been performed for a flat wing by F.W. Schmitz and the wing profile is called the Gottingen flat plate (l). They have been reported for two Re of 168,000 and 42,000 respectively. The flat wing profile is quite peculiar in that the lift coefficient increases linearly up to an angle of attack of about 5° and then drops of dramatically at higher angles. At 5°, \( C_l \) also decreases by a factor of about 1.2 as we go from Re 168,000 to 42,000. From equation (1) we can calculate the lift coefficient required to fly our EZB at a speed of 1 meter/second by equating to the weight (mg) of the airplane. This is standard procedure and is, indeed, the way in which \( C_l \) is calculated from experimental data. If we now calculate the \( C_l \) required to fly the EZB at 1 meter/second we obtain a value of 0.529. Now if we compare to the data for the flat plate at Re 168,000 we find that, at 5°, the value for \( C_l \) is about 0.5 and everything seems hunky dory. But wait a minute. Our EZB is flying at an effective Re of about 5000, not 168,000. If we assume that the Re continues to decrease at the rate of 1.2 described above, the lift coefficient would be about one tenth of its reported value at 168,000. “Something is quite rotten in the State of Denmark”. The Bernoulli effect only supplies about 10 % of the required lift and the airplane would not fly at all at this speed. Yet our EZB’s do fly surprisingly well. The real question is what kind of magic flies our planes at such low Reynolds numbers? It is most certainly not the pure Bernoulli effect. As we know, the real answer to this question is locked in the secret of the subject of the aerodynamics of very slow flight. This subject is beyond any kind of exact theoretical treatment available at this time. We can, however, replace the bad concept of Bernoullian air (BA) with another which we will call “Non-Bernoullian Air” (NBA).

NBA can be defined as air in which lift and drag on a moving object are produced entirely by the net momentum transfer (i.e. impact force) of air molecules moving in a certain direction near the surface of the object. The concept is illustrated in terms of a simple model for NBA as shown in
figures (1), (2) and (3). The object chosen is a flat plate moving very slowly in air with velocity $v$. For comparison the Bernoullian airflow is illustrated for the same object moving rapidly in air (figure 1).

The flow conditions in figure (2) are assumed to be quite different from those shown in figure (1). On the lower surface in figure (2) there is a net downflow (downwash) of air over the entire surface. The flow is assumed to proceed outward at angle $\theta$ which is also the angle of attack as shown. The situation is very different on the upper surface. As the plate moves through the air a partial vacuum is created behind it. Air must flow in toward the surface in order to maintain the static pressure.

We have attempted to illustrate the forces acting on the wing in NBA as shown in figure (3). In order to calculate the force on the lower surface we imagine a stationary flat plate with air molecules moving toward it with net flow velocity $v$. Note that $v$ is the velocity of flow not the true random thermal velocity which is required to produce the static pressure of 15 lbs./sq.in. If a given molecule strikes the plate with a perfectly elastic collision, it leaves the plate in the direction shown and produces an impact force $= 2mv \sin \theta$ where $m$ is the molecular mass. Here $\theta$ is the angle between the plane of the plate and the direction of motion, i.e. the angle of attack. The total force on the plate is equal to the force per molecule times the total number of molecular collisions per unit time. This collision number is a standard expression in the molecular theory of gasses and is given by $Z = N A v \sin \theta$ where $N$ is the number of molecules per unit volume, $A$ is the total surface area of the plate and $v$ is the flow velocity. The total force is then given by $F = 2mN A v^2 \sin^2 \theta$. The force on the upper surface is not as easily determined. Here we must imagine that the plate moves and creates a partial vacuum as mentioned previously. The decrease in pressure on the upper surface tends to increase the total force $F$. For NBA we make a completely empirical assumption. We assume that the reduction in pressure on the upper surface is equal to the increase on the lower surface so the total force is $4mN A v^2 \sin^2 \theta$ as illustrated in figure (3). This force is then resolved into lift $L = F \cos \theta$ and drag $D = F \sin \theta$. Actually the empirical assumption made above can be somewhat justified by including the average thermal velocities of air molecules but a discussion along these lines is too long and involved to be included here.

It is clear that the model for NBA presented above is an abstraction and complete oversimplification of what actually happens in real air. Within the framework of the model, however, no fundamental scientific principles have been violated. On the other hand streamlined Bernoullian flow is also an abstraction and BA also does not describe what really happens. In essence the model for NBA is a simple attempt to describe lift and drag in terms of “pushing on air” at very slow flight speed. As mentioned previously I am quite inexperienced in the world of indoor flight. It would be extremely presumptuous of me to assume that anything said here would not be known to you in some way based on your own knowledge and experience. All I propose to do is to present a different point of view which may be useful in helping to understand the difficult problem of very slow flight.
2. Lift and Drag on a Flat Plate in NBA

As we know the lifting surfaces (i.e. wing, stabilizer, fin and rudder) of an indoor endurance model somewhat resemble those of a flat plate. The plate we imagine is infinitely thin so that it has no resistance (drag) at zero angle of attack. The resulting equations for L and D in NBA are:

\[
L = 4mN\rho A v^2(\sin^2\theta \cos\theta) = 4\rho A v^2 (\sin^2\theta \cos\theta) \quad (3)
\]

\[
D = 4mN\rho A v^2 (\sin^3\theta) = 4\rho A v^2 (\sin^3\theta) \quad (4)
\]

where we have substituted \( \rho = mN \) which is equal to the air density. It is most interesting to find that these equations have the same form as the Bernoulli equations (1) and (2) for streamlined flow. For purposes of comparison we can make both equations exactly the same by defining the lift and drag coefficients in NBA as follows:

\[
C_l = 8\sin^2\theta \cos\theta \quad (5)
\]

\[
C_d = 8\sin^3\theta \quad (6)
\]

One can play many interesting games by comparing equations (1) and (2) for BA with equations (3) and (4) for NBA. In making such comparisons one must remember that we are, in effect, comparing apples with oranges. We are comparing the conditions for perfectly streamlined (tangential) Bernoullian flow (Apples) with those described above for NBA (oranges). Now we must be very careful by what is meant when we compare the two. This we have done for the Gottingen flat plate in figure (4) The experimental wind tunnel data for the flat plate were obtained at \( Re = 168,000 \). If the EZB is “flying” at this Re, the air passing tangentially over the wing would be traveling at about 32 meters/second or 67 mph. None of us would even begin to think of subjecting our favorite model to this malicious airflow in order to achieve the correct amount of Bernoullian lift. The \( C_l \) curves for both BA and NBA are identified in the figure. The dotted line represents the \( C_l \) of about 0.5 required to fly the EZB at 1 meter/s. As can be seen from the figure this amount of lift is not achieved in NBA unless the models flies at a whopping 15\(^\circ\) angle of attack. Now remember that the theory for NBA is an abstraction and we cannot attribute much credence to the absolute values of these calculated numbers. On the other hand we can draw some interesting conclusions. In order to fly at a high angle of attack in NBA we have to deal with increased drag. This requires increased power. That is, our indoor endurance models fly at very low speed at the cost of increased power as compared to what would be required if we had perfectly streamlined tangential flow over the wing. Now I do not know what the actual angle of attack of our bench model is when it flies to your satisfaction. It does appear to me that these models are sort of hanging at relatively high angles. One often hears that the best solution to efficient flight is to fly close to the “stall” angle. However the stall angle in BA and NBA are very different things.
indeed. In BA the angle of stall is conventionally defined as the angle of attack at which the $C_l$ reaches a maximum and starts to decrease at higher angles. The very reason for this definition is that the airflow ceases to be Bernoullian and begins to become turbulent thus producing less lift. In pure NBA the $C_l$ reaches a maximum value at an amazing $57^\circ$. At this angle however, as we shall see, the wing is also producing a huge amount of drag which amounts to more thrust than would be required to raise the airplane straight up.

What then is the major point of this discussion? The major point is that, at very low flight speed, there is little meaning in speaking about stall in the conventional sense of commonly accepted aerodynamic theory. The angle of “stall” simply means the angle of attack at which the largely non Bernoullian air produces enough lift to maintain level flight. This view tends to focus us on the importance of the angle of attack required for our real model in real air. Here we have neglected an important factor in the above discussion. In my humble opinion the endurance model behaves more like an object possessing two wings with different surfaces areas. Of course there is nothing new about the assumption that the stab also produces lift but this consideration dramatically changes the value of $\theta$ required to produce level flight.

It is also interesting to compare the effect of drag in NBA vs BA. Here we find another essential difference; namely that NBA produces more drag than BA at a given angle of attack. This is best compared in terms of $L/D$ which is a kind of measure of the wing efficiency. The $L/D$ ratio is shown on the right hand side of figure (4). For BA this has been estimated from the experimental data on the Gottingen flat plate. Note that $L/D$ is independent of the velocity of flow over the wing so we can use the experimental values reported. For NBA the ratio is simply $L/D = (\tan \theta)^{-1}$ as is easily determined from equations (3) and (4). We see that, at higher angles of attack, the wing in NBA, is considerably less efficient than in BA. That is, the wing in NBA produces more drag. This is another reminder that although our airplanes fly quite well in NBA, they require relatively more power to do it.

Finally there are several gross differences between NBA and BA which should be mentioned. First of all we note that in NBA there is no vortex drag. The effects of drag are produced entirely by what we would call profile drag in BA. As far as lift and drag are concerned, features such as tip stall, aspect ratio, and wing shape, which are quite important in BA, are seemingly irrelevant in NBA. On the other hand these features may still be important in determining other factors such as flight stability. Also we note that in NBA the center of pressure is at the center of the (flat) wing not at about $1/3$ of chord as it is in BA. This result alone may lead to interesting discussion, and controversy, about the location of the C.G. in the indoor endurance model.

The concept of “pushing on air” can also be applied to the cambered wing and to the very slow propeller. Space is limited, however, and such considerations are postponed subsequent to establishing the level of interest in this admittedly oversimplified approach to the problem of slow flight.

Reference (1). Model Aircraft Aerodynamics, Martin Simons, 1999, 4th Ed, Nexus Special Interests Ltd. The data for the Gottingen Flat Plate were taken from this excellent book. The text is based on the standard aerodynamic theory of flight and nothing said here should, in any way, be attributed to the author of this book.
Yak 12R

Dave VTO Linstrum

MIAMA
Miami Indoor Aircraft Model Association
MATERIALS
MOTORSTICK .100 x 1.875 DEEP TAPER ENDS TO .100 x .140
FROM 5.0 LB C GRAIN SHEET
BEARING WIRE PIGTAIL .020 DIA.
REAR HOOK .020 DIA.
BEARING/HOOK GUESSET .032 5.5 LB A GRAIN

BOOM .100 x .130 TAPER TO .045 x .060
FROM 4.8 LB B GRAIN SHEET.

WING SPARS .063 x .063 4.2 LB A GRAIN
RIBS .030 x .063 DEEP A GRAIN
WING POSTS .065 ROUND 6.0LB

STAB SPARS .063 x .063 4.0LB A GRAIN
RIBS .030 x .063 DEEP A GRAIN

FIN OUTLINE 2 LAMINATIONS OF .030 x .063
LAMINATE USING 80% THINNED WHITE GLUE.

PROP SPAR .090 TAPERED TO .065 ROUND
FROM 8.0 LB INSET INTO BLADES
BLADES .030 3.7 LB C GRAIN
SHAFT .030 DIA WIRE.

ALL SURFACES COVERED WITH
PRE SHRUNK AND WRINKLED JAPANESE
TISSUE PAPER.

BUILT IN ADJUSTMENTS
THRUST: 0 DEG DOWN 2.5 DEG LEFT
WING: FLAT NO WARPS WITHOUT MOTOR
STAB: .020 WASHIN ON THE STARBOARD
SIDE TO AID IN KEEPING TURN
FIN: .063 OFFSET FOR LEFT TURN

A-6
DESIGN/DWG: V. LINARDIC
10/10/01
COVER MODEL WITH ULTRAFILM. STRUCTURALLY
MODEL IS VERY SIMILAR TO MODELS FLOWN 5+
YEARS AGO.

WEIGHTS
WING 0.39
PROP 0.22
REST 0.49
BALLAST 0.10
TOTAL 1.20 GRAMS

CAT IV RECORD 21:48

F1L EASY-B MODEL
DESIGN/DWG. V. LINARDIC
15/05/01
"Hybrid" F1D wing design
by Tim Goldstein
timg@IndoorDuration.com

This design came about because I wanted to try an unbraced wing and did not have time to build one for the team trial. Thinking what I could do it dawned on me that I could get the function of an unbraced with this scheme and just apply it to a current braced wing. Into the bracing jig the wing went and off with the existing wire and cabane. Added the 2 little posts and on with new wire. Took about 15 minutes and I was ready to try the unbraced concept. At the team trials I was using the traditional braced wing. Was having terrible problems at launch with barrel rolls and power stalls. My F1D looked like an overgrown ministick. After fighting the plane for 2 days with everything I could think of and all the suggestions I could solicit, I finally switched to the hybrid wing. Launched at the same torque that was giving me some interesting aerobatics and a climb to 120 feet. This time it climbed out like an F1B and immediately planted itself in the girders at 185 feet in just under 6 minutes. Was lucky to get it down with a balloon. Launched at a lower torque and continued to fly. Been using the design ever since and now am using the 3 rib design shown instead of the original 5 rib.

The advantages as I see it is consistent spar stiffness in varying humidity and much lower weight than a true unbraced design. While it is pretty easy to bring a F1D55 in under weight this gives me even more leeway so I can play with CG by moving the ballast and start work on modifying my model to pack smaller with a dual plug-in tail and not worry about going over weight.

VP Prop Hinge System
By John Kagan

1) Polyspan “L” hinges, double glue w/Ambroid
   1a & 1b counter prop torque
   1c counters spring torque
   1d prevents separation
2) Actuator arm attachment, solder

Reference Steve Brown’s VP article INAV 89
Making tissue decals for P-Nuts & No cal and any other scale models.
By John Tipper

- First of all photo copy the plan 1 or 2 copies is enough.
- Next select the first marking you wish to reproduce, start of with a simple letter or number on the wing.
- Roughly cut out the letter from the plan leaving a 1/4" boarder around the template.
- Using a can of non permanent spray mount, give the under side of the template a very light spray, this just needs to be enough to stick the template to a piece of coloured jap tissue, lightly press template on to tissue.
- Next carefully cut out the decal with a sharp knife or good pair of scissors.
- For the next stage use a permanent spray mount to give a good spray on to what is the underside of the tissue decal, at this stage the paper backing must still be in place, this helps to keep the decal in good shape and flat.
- Lay the decal down on to its place on the model, once in place, gently press down and allow tissue to bond to wing tissue.
- When set use a fine point of a scalpel to gently peel the paper backing of off the wing leaving the tissue decal in place.
- For best results lay decals on to flat tissue then cover model when decorations are finished.
German Indoor Championships, Cargo Lifter Hanger, October 13-14, 2001

Aerial View of the Base

Closeup in Summer

An F1D Floats By

Peter Keller

Nick Aikman

Laurie Barr and Big Bazooka F1M

The Lineup of Tables

And Still More Room

Midair’s Were Rare, but Happened

Ron Green was top British Flier

Mikita Kaplan came from the Czech Republic

Mikita’s Daughter Klara got 25.09 in F1D and a 17.36 in F1L

Another whoops. Carl had these ready for 105 and I forgot to print them. Sorry, Tim
MINI STICK, how it all began.
by Thomas Vallee (USA)
From Indoor News June 1994

It may be of interest to note that the Mini Stick (Living Room Stick:) event was originated by Pete Staehling and myself as a special fun event for an "indoor bull session" of the Goddard Indoor Flyers. At these sessions we would do planning for the groups upcoming flying season and discuss indoor matters in general. We would also drink a good deal of good beer and consume generous amounts of home made baked beans or 3 alarm chili. Thus, a beer party was the inspiration for Mini Stick.

This is how the first Mini Stick contest came to be held in my living room. We had six contestants and the winning time was about 3'30. Since then Mini Stick has come a long way. The original rules were almost identical to present rules except that there was no weight limit. We determined the proper weight limit by weighing all the models. The .015 ounce (.43 gram) minimum weight is heavier than models built by our indoor experts but slightly lighter than the models built by our beginners. It seems to have been a good choice.

After the first few contests we saw possibilities of Mini Stick as an ideal entry level event which could be fun for expert and beginner alike. We began to promote Mini Stick outside our own group with great success. One thing we liked about the event was that it filled a special need not met by other events. It could be flown seriously in small rooms not suitable for other large indoor models. Mini Stick was a partial solution to the flying site problem. Our motto was "IF YOU HAVE A LIVING ROOM, WITH MINI STICK YOU HAVE A FLYING SITE". This was the inspiration for Mini Stick's alternate name, Living Room Stick (LRS).

I realized just how far Mini Stick has come since those first days, when I saw about sixty of these little ships filling the air in the Mass Launch* competition at the US Indoor Championships (* we have both standard duration and mass launch competitions at the USIC). Developing Mini Stick has been a lot of fun for me. It has been particularly pleasing to see so many people, having so much fun with our little brainchild, particularly the beginners

Hope you find this history of the origins of Mini Stick to be of interest.

A point to ponder

Lew Gitlow of Indoor Model Supply ( www.IndoorModelSupply.com ) wrote us a letter and gave us a proposition that just happened to fit in nicely with the article in this issue by Vernon Neff. What Lew asked was the following:

1. On the wings used for out slow speed indoor flying models (single covered arc), what percentage of the lift is from the airfoils top surface vs the bottom surface?
2. On a typical outdoor model with a double covered Clark Y section what percentage of the lift is from the airfoils top surface vs the bottom surface?

Lew’s proposal was that if we asked the question of our readership and get a response that he would look over the tally of the results and give use some commentary and experimental test results as for publication in a future INAV.

So, lets get your input on this and put Lew to work writing something for the next INAV. Send your thoughts on this to Carl. His address and e-mail is in the front of this issue.

% lift______ % lift______

% lift______ % lift______
A 4 day event that is really multiple contests in one. All AMA classes, FAI classes, the Wally Miller EZB contest (1.2 gm), and an FAC contest. This is a world class 145' ceiling site with a layout that allows multiple classes to be flown at the same time. Light weight slow flying speed classes are flown in one end of the building and heavier faster flying classes are flown in the other. The middle area serves as a buffer between the two. This tremendous layout allows you to fly all classes of models any time during the entire event without the rush and concern of per class time slots (gliders excepted as they are limited to 1 hour each morning). This fun format allows for very relaxed flying and great camaraderie. There are no trophies, but instead in a great Kibbie Dome tradition contestants and supporting indoor vendors bring indoor oriented products, tools, supplies, and gadgets to put into a prize pool. At the closing award ceremony top placing contestants are allowed to pick their prize form the pool.

Special room rates are available at the University Inn in Moscow, ID. This is a Best Western hotel that is very nice with a full range of amenities. This hotel is within sight of the dome and is the "official" hotel for the event. The reservation phone is 800 325-8765 and the group discount is listed under AMA Modelers. Room rate is $52.50/night and all rooms have a little refrigerator and there is a grocery store next door. Hotel website is http://www.uinnmoscow.com

Come on out and learn why this contest continues to increase in participation every year. Registration is on site with no pre-registration required for the contest.

Contest CD:
Andrew Tagliafico
10039 SW Quail Post Rd
Portland OR 97219

Site drawing shamelessly borrowed from Indoor News May 1996
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