Indoor News

Issue 49 March 1999



DIARY

2-6 June Johnson City USA	**1999 Indoor National Championships** East Tennessee State University, Johnson City. Info: 5432 Haft Rd., Cincinnati, OH 45247, USA. See details elsewhere in this issue
19-20 June Bordeaux France	**French Indoor Championships/1st Indoor International,** Stadium of Bordeaux. Info: Jean Pierre Darrouzes, 32, Avenue du Maréchal de Lattre de Tassigny, 33610 Cestas, France, tel. 05 56 07 6566. See details elsewhere in this issue.
2-5 Sept Saint-Severin Belgium	**21st International Indoor Contest** Tennis Hall du Condroz, 12 Chemin de Fraineaux, Saint-Severin. Info: Bernard Delhalle, Rue de Souvret, 62, B-4000 Liège, Belgium. E-mail: bs361614@skynet.be. See details elsewhere in this issue.

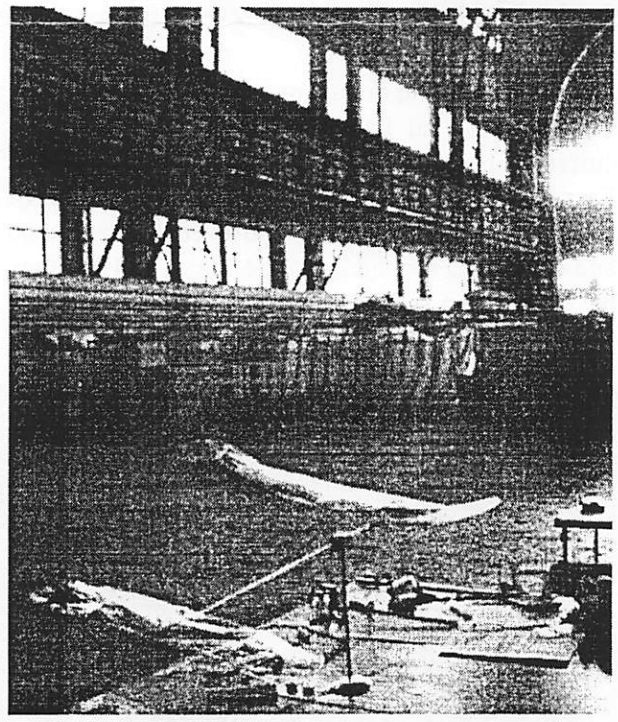
A Swede visits Lakehurst

by Jonas Romblad (SWE)

It was early July and the summer vacation plans were made up. A long week in St Louis and then a visit to my brother, who was living in New York at the time. Due to a number of fully booked flights, the return flight was booked four days later than planned. What to do with four extra days in New York if big cities are not your fancy? How about something related to indoor modelling?

After some research I found out that Lakehurst is located less than a two-hour drive from New York City. When calling for more information I was greeted by Gary and Kit Underwood, two of the nicest people on this earth. Before long Gary had me set up with driving instructions, trimming suggestions, a personal flying coach (him self) and a bed in the guest room of the Underwood residence. It all went so quickly I hope I did remember to say 'thanks'!

So, I was going to one of the best cat. IV sites in the world. Although my indoor experience dates back over a dozen years, most flying had been done in cat. I and II sites and on a few occasions in a turbulent cat. III. The site was there, but what about models and equipment? I decided to build a new



An F1D-model in the vast space of Lakehurst

COLOPHON

Indoor News is published at least four times a year and covers all types of indoor models, from peanuts to microfilm. Texts can be sent in Dutch, English, German and French. Please type your texts on 12,5 cm width. Texts can be sent on floppy disk (3½ or 5¼) in any text format. I can make drawings, if you are no draftsman.

Payment of subscriptions is preferred per eight issues. When paying by Eurocheque, **International** Postal Money Order or with bank notes no additional bank fees are required. Please add NLG 6,50 for bank fees when paying by Eurogiro or NLG 20,00 with foreign checks. The Eurogiro account number is 4406860.

Editor:
Thedo André
Meijhorst 35-43
NL-6537JD Nijmegen
The Netherlands
Phone/Fax +31 24 3450711
E-mail: Thedo.Andre@net.HCC.nl

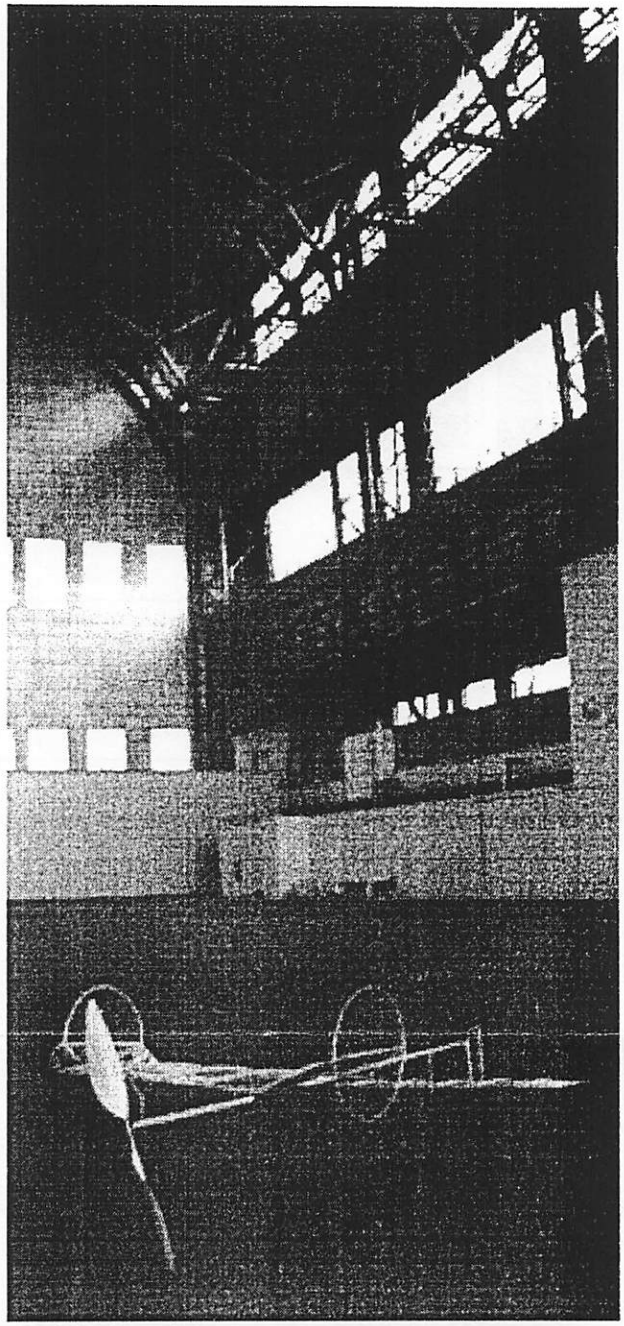
Subscription:
(per 8 issues)
Holland NLG 28,-
Europe NLG 30,-
Airmail USD 20.00

F1L and also to bring my trustworthy F1M model. During a quite hectic week a new F1L model was built as well as a transportation box adapted to the airline rules for carry on luggage. When the last model part was in place in the finished box there were about seven hours to pack the bags and get a quick nap before leaving for the airport.

The travelling was mostly uneventful and I only had to open the box at one security checkpoint (there had been no time to add a window). The lady at the checkpoint got curious when the x-ray machine didn't pick up a thing inside my box, and since very few travel with empty boxes as luggage, she asked me to open it. When the lid came off she peered inside and when she realised that the flimsy, transparent things in there was my luggage she smiled and said: "No problem to get an overview of your luggage. Have a nice flight!".

Much to my surprise none of the models suffered any damage whatsoever on any of the seven or so flights. After the previously planes vacation activities I said good bye to my brother, rented a car in New York and followed the directions to the grand residence of the Underwoods where I was warmly greeted by Gary who immediately installed me in a gorgeous guest room. After checking the models for damage after all the travelling, we set out for Lakehurst Naval Air station.

A few background details may be appropriate here. The Hangar 1 at Lakehurst Naval Air Station is currently used by the Navy, mainly for storage. The East Coast Indoor Modellers have, through a lot of good work, access to this site every (!) weekend and extra days around major holidays. In 1999 they have 113 or so scheduled flying dates! The driving force behind this is Gary Underwood. Gary encou-



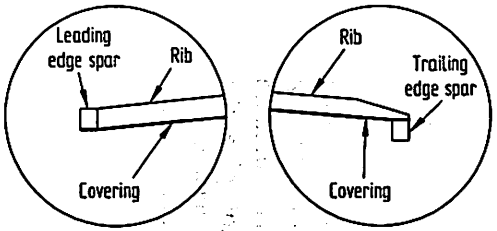
My F1M model



Kit and Gary Underwood

rages indoor fliers from every city and every nation to come and enjoy the vast flying space of Hangar 1 and he backs it up by the greatest portion of hospitality I have ever encountered.

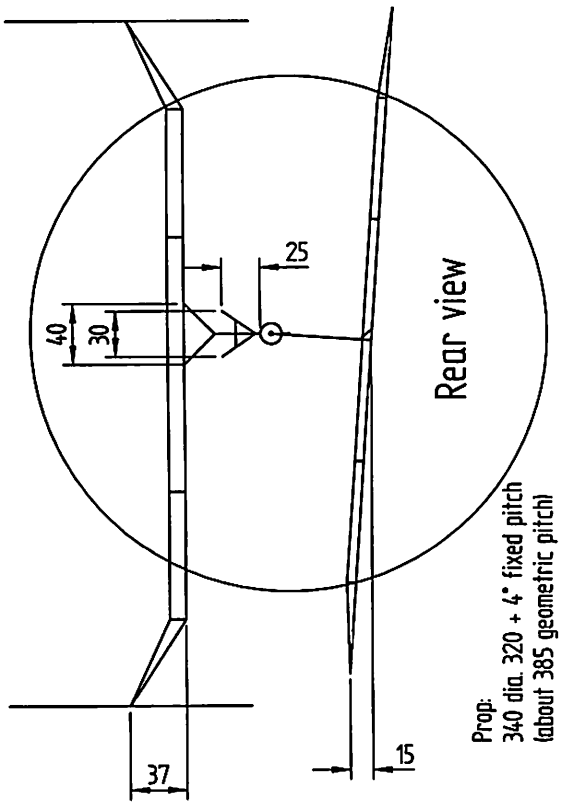
I will not bore you with long stories of how big Hangar 1 is, because words can not give the place justice. The 78 by 242 meter floor and 51-



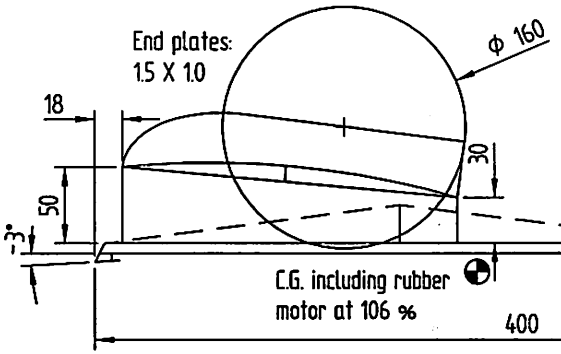
Wing and stab are covered on the under side of the leading edge and ribs but on top of the trailing edge.

Covering technique:

Put the oversize film on a piece of paper. Curve the paper to match the underside of the wing. Lay wing on top of the film and attach to the leading edge and ribs using thinned rubber glue and a brush. Turn the wing upside down. Use a hot soldering iron to cut slots in the film at each rib. The slots should start just ahead of the trailing edge and follow the extension of the rib to the edge of the oversize film. Make the slots slightly wider than the rib. The film between each rib can now be pushed over the top of the trailing edge and glued in place.

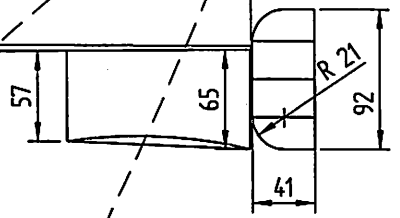


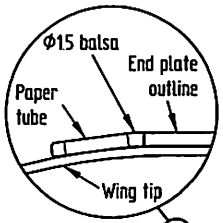
Prop:
340 dia. 320 + 4° fixed pitch
(about 385 geometric pitch)

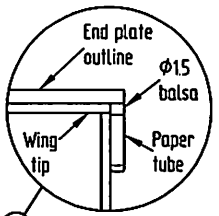


Wing and stab posts Φ 1.5

Fin:
Outlines 1.0 X 1.0
Ribs 0.7 X 1.0
4% arc



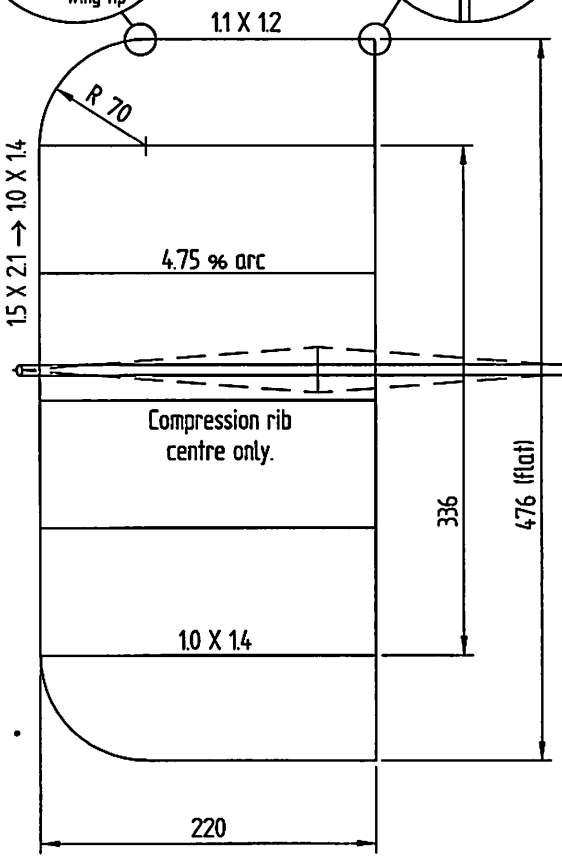


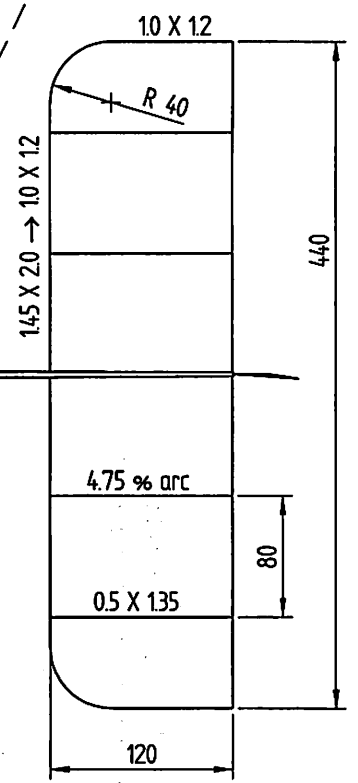


Gentle Riser

F1D-beginner (50-öres) for low cielings by Jonas Romblad, Sweden.
Traced by Jonas Romblad 1998.

Best times:
Örebro, Sweden (cat. II) 11:08
Lakehurst (cat. IV) 18:10







Weights

Wing	0.92 g
Stab	0.36 g
Fuselage	1.11 g
Propellor	0.53 g
Ballast	0.15 g
Total	3.07 g

100 mm

All dimensions in mm

meter ceiling says a little, but it can not communicate the feeling of it. I can only recommend going there yourself, with or without models.

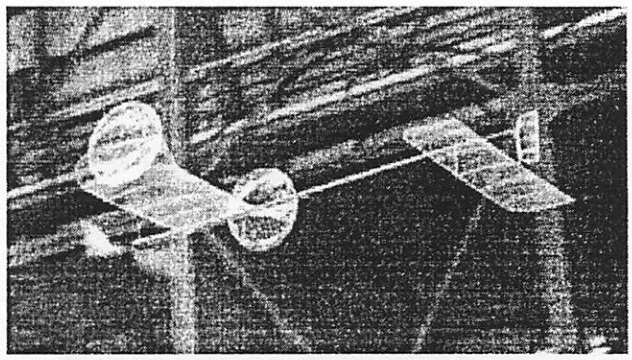
As for flying, the Hangar 1 is great. During my stay there the drift was very low and I had flights over 17 and 18 minutes with the F1M model landing 20 meters away. Since this session took place in early August, temperatures were high, as was the humidity. This did affect the models significantly and retrimming was required to achieve the desired flight paths. Although there were many kinds of models in the air at times, collisions were not an issue as it is almost hard to put two models in the same place in such a huge volume of air. Adding to the positive experience was the friendly and laid-back attitude among everyone involved.



Thomas Merkt

On Saturday there were a number of local fliers present as well as Thomas Merkt from Germany. The average age of the local fliers were well past retirement age and some of the gentlemen had very good stories to tell about indoor flying back then. One gentleman well into his seventies gave me the serious advice to build the complicated models while being young and able. He claimed he was recently getting problems seeing the bracing wires on his F1D models. I happily accepted the advice, thinking that if I will be able to build half as beautiful models when I retire, I will be a happy old man.

For those of you have never flown under a high ceiling, I can assure it is something different. To launch a model at twice the normal torque and see it take off in a 40 degree climb is something, having the model keep climbing like that for almost a minute puts a new perspective on flying. Models tend to get smaller than you'd ever imaged while climbing for the ceiling and how the locals can balloon steer at these altitudes, I may never understand. Flying in a cat. IV site also proved to be harder on the equipment than on the models. I broke numerous rubber motors and one torque meter but not a single piece of balsa. The flight time summary was greatly increased personal bests and unofficial Swedish records in F1L with 20:01 and 18:10 in F1M using a fixed pitch prop (Swedish 50-öres rules).



Gentle Riser on its way to 18 minutes

Exhausted after a lot of good flying and with many new friends made, I headed toward the flight back home on Sunday afternoon. Thanks to the excellent directions by Gary Underwood, I arrived to the airport with plenty of time left and before even boarding the plane, possible plans for returning to Lakehurst were already forming.

To Gary and Kit Underwood the sincerest thank you for being the most wonderful hosts for a foreign indoor flyer, way out of his regular tracks. To all the wonderful fliers I met at Lakehurst, thanks for sharing a magic weekend - hope to see you there again some day.

(A plan of Jonas' F1M model is published herewith. A description of the model and its aerodynamic details can be found on Daniel Hartstein's website http://w1.871.telia.com/~u87106779/ and in IN 46.)

French Indoor Championships/1st Indoor International

Stadium of Bordeaux, Quartier du Lac
19-20 June, 1999

Organisation: Association Sportive et Culturel Pessac Alouette Section Aeromodelisme.
Hall: Stadium of Bordeaux, ceiling height 30 m, floor area 3000 m^2.
Classes: F1D, F1M, EZB 1.2 gram, Micro 35 Cadet, Junior and Senior.

Fees: 100FF for first category (+ 50FF for each additional category); 50FF for cadets and juniors (+ 25FF for each additional category).
Inscription: before 30 May 1999 (fees are doubled for inscription on the spot).

Schedule (preliminary):

Saturday 19 June	
08.20-10.20	Training
10.20-11.40	Micro 35 Senior
11.40-13.00	F1M
14.00-15.20	Micro 35 Cadet, Junior
15.20-16.40	EZB
16.40-19.30	F1D

Sunday 20 June	
08.00-09.20	Training
09.20-10.40	EZB
10.40-12.00	Micro 35 Senior
13.00-14.20	F1M
14.20-15.40	Micro 35 Cadet, Junior
15.40-18.20	F1D

For further details like lodging, banquet, etc. contact: Jean Pierre Darrouzes, 32, Avenue du Maréchal de Lattre de Tassigny, 33610 Cestas, France, tel. 05 56 07 6566. E-mail: Trung Hua-Ngoc, Hua.Ngoc@wanadoo.fr

21st International Indoor Belgium

This year there will again be an International Indoor Contest in Liège, Belgium. The contest will take place from 2-5 september 1999 in the "Tennis Club du Condroz", 12, Chemin de Fraineaux, 4550 Saint-Severin (Nandrin), Belgium.

All categories are accepted and proxy flying for Pistachio/Peanut models will be allowed. There is again a Fun Fly Contest for "Extravagant" models. Please note that for Sainte Formule the minimum weight has to be 3 grams. The hall measures 47 x 36 m. Ceiling height is 10m, with 7,5 m free height till the lamps. Information contact: see Diary. Here is the flying program:

Thursday:	09.00 - 10.30	Trimming
	10.30 - 12.45	F1L, Micro 35
	13.00 - 14.45	F1M Beginner
	15.00 - 16.30	F1D
	17.00 - 18.30	Ste Formule
Friday:	09.00 - 10.45	F1M-Beginner
	11.00 - 12.20	Ste Formule
	12.30 - 14.45	F1L, Micro 35
	15.00 - 16.15	F1M Beginner
	16.30 - 18.30	F1D
Saturday:	09.00 - 10.50	Ste Formule
	11.00 - 12.30	F1D
	13.00 - 16.20	F4F, Pistachio
	16.30 - 18.00	F1L, Micro 35
Sunday:	09.00 - 10.00	Trimming
	10.00 - 18.00	F4D, F4E, F4F, Pistachio
	18.00 - 19.00	Fun Fly
	19.00	Results

Contests in Belgium

16 May - Flémalle, Salle A. Cools, rue du Beau-Site, 25, Flémalle (Trixhes). Contact: F. van Hauwaert, Rue de l'Hermitage, 4400 Flémalle.
30 May - Chimay, Salle du Sudhaina, Baileux. Contact: Emile d"Hondt, Chausée de Couvin, 6460 Chimay, tel. ++ 60-211778.
2-5 Sept - St Severin, 21st International, see details above.
17 Oct - Strépy-Bracquegnies, Centre Culturel. Contact Jean-Marie Melice, Rue Ch. Bernier, 36, 7110 Maurage.

Slanic Video

I do have available a video tape from the last World Championships F1D in Roumania. Due to interest in this I am publishing the cost of the tape. But first of all I will describe the contents of the tape.

The tape is an edited version of my home video tape (8mm). It will give you a really good impression about flying in the Saltmine. However the light conditions in the mine are very poor, so some of the images are a bit grainy, and sometimes the autofocus is lost due to insufficient light. So this tape is not broadcast quality, but I am still amazed about the captured images. My edited version shows in 1 hour and 15 minutes a good impression of the harsh flying conditions in the mine.But as I was flying as well, I had to limit my taping only at times I was not flying. I think this is the only video tape available on flying in the Saltmine.

I made 50 copies in NTSC and 30 copies in PAL (Europe). The tape has undertitles to explain the different scenes. And if you like indoor, you have to see this tape! The quality of the NTSC copies is good, compared to home videotaping. The quality of the PAL version is unknown to me. I was not able to view it, but I shipped one copy to Holland, and it seems ok (Note from T.A.: I can confirm that it's excellent. This tape really is a collector's item!). To make this affordable to everybody, I decided to make the NTSC version and the PAL version the same price. (basically the NTSC copies are subsidising the more expensive PAL version). The tape is US $ 26,- post paid to anywhere in the world.

The catch is that the quantity of the PAL version is limited. To make additional NTSC version is not a problem. If you like to have a copy, please email me at eliem@dowco.com and give me your mailing address and NTSC or PAL version and I will respond by email. Payment can be done in US $ cash, or in US $ cheque or in Euro cheque in Dutch guilders (let me know if you want to use this option).

Festina Lente !

Edmund Liem, 6475 Evans Road, Chilliwack, B.C., V2R 1K8 Canada, Ph +1 604 858 6421.

F1M PROPELLER DESIGN.

KAI K. HALSAS

In the following I will try to describe how a "standard" propeller blade could be designed and formed for a specific F1M model. The same blade could be used for different pitch values.

1. WHAT IS PITCH?

The pitch is the distance the propeller travels forward during one revolution.

2. HOW TO CALCULATE THE PITCH.

The travelled distance (pitch) can be calculated when forward velocity and propeller rotating speed are known. I am going to call this distance *THE BASIC PITCH.*

The equation for calculating the basic pitch is = $\frac{\text{FORWARD VELOCITY}}{\text{PROPELLER ROT. SPEED}}$

3. DESIGN EXERCISE.

Type of model	F1M.
Propeller diameter	390 mm
Propeller radius	195 mm
Blade length	165 mm
Forward velocity	0,9 m/s
Propeller revolutions	1.75 RPS = (105 RPM)

4. FORWARD TRAVEL IN ONE SECOND.

$$\frac{900}{1,75} = 514\text{mm}$$

This is now now THE BASIC PITCH

5. BLADE ANGLES

We calculate the blade angle and relative pitch at station 0,7, for the BASIC PITCH

$$\text{ATAN}\frac{514}{\pi * 390 * 0,7} = 30,9°$$

$$P/D = \frac{514}{390} = 1,32$$

The following step will be to calculate the blade angles at different stations along the propeller radius

6. BASIC PITCH BLADE ANGLES AT DIFFERENT STATIONS

In the enclosed table No 1 are shown blade angles at different stations

Table No 1

STATION	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1
BLADE ANGLE	76,6	64,5	54,4	46,4	40,0	35,0	30,9	27,7	25,0	22,8

7. BLADE FORMING

We have now all information we need for blade forming. We have the basic pitch 514 mm (P/D = 1,62) and we have blade angles at different stations. used for different
The blade can be formed

a) on a cylinder

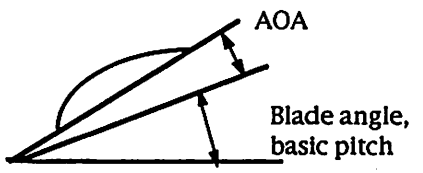
b) on a conical surface

c) specially carved forming block

8. WHAT TO DO WITH THE BLADE ?

We have now formed the blade. How to proceed? The blade must be glued on the propeller spar. The angle at which the propeller is glued to the spar will determine the performance and pitch of the propeller. If we glue the blade with an angle from Table No 1 then the propeller will create almost no thrust. Why? The *angle of attack* of the blade in relation to the relative wind during motion would be 0°.
We remember that the wing of our model must have an angle of attack, in order to create lift. This applies also to the propeller

Fig. No 1 shows schematically how the angle of attack is added TO THE BASIC PITCH. The angle of attack (AOA) varies usually between 2 - 10°



Fig, No 1

9. HOW SHALL WE GLUE THE BLADE TO THE SPAR?

The blade is usually glued to the spar using some kind of pitch template. The template is usually 45°. We must now decide what AOA we shall use. We decide to use 8° angle of attack.
Where should the 45° template be located? It must be located at the station for basic pitch blade angle 45° - 8° = 37° Enclosed Table No 2 shows the location of the 45° template at different angle of attacks. You will notice that for the 8° angle of attack the 45° template is located at 0,56 x 195 = 109 mm. of the radius.

Table No 2

P/D = 1,32
Basic Pitch = 514 mm
r = 390/2 = 195

AOA °	2	3	4	5	6	7	8	9	10
Stat.	0,45	0,47	0,48	0,50	0,52	0,54	0,56	0,58	0,60
r mm	88	91	94	98	101	105	109	113	117

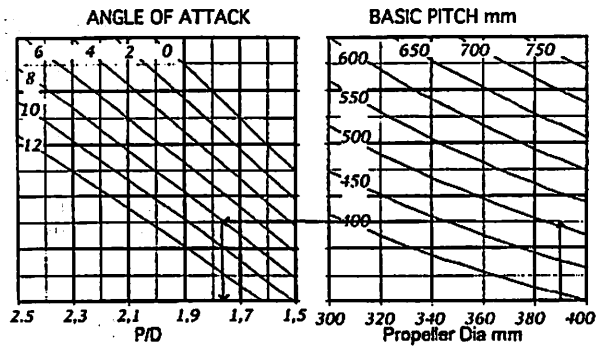
10.WHAT IS THE EFFECTIVE PITCH?

P_{eff} = (Basic Pitch + AOA)

What is the efffective pitch at statioon 0,7 with an AOA of 8°?
From Table No 1 we have a blade angle of 30,9° at station 0,7 We calculate now the pitch for a blade angle of 30,9° + 8° = 38,9°

P_{eff} = TAN 38.9° * 2 * π * 0,7 * 195 = 692 mm. P/D = 692/390 = 1,77

We can also read the P/D = 1,77 from the enclosed nomogram. The values on the P/D axis are calculated for station 0,7.



We have added the same AOA to each blade angle. From this follows that the pitch distribution is not exactly helical (geometrical). The difference is not significant, as we can note from Fig, No 2

The straight band in Fig. No 2 corresponds to the helical pitch distribution

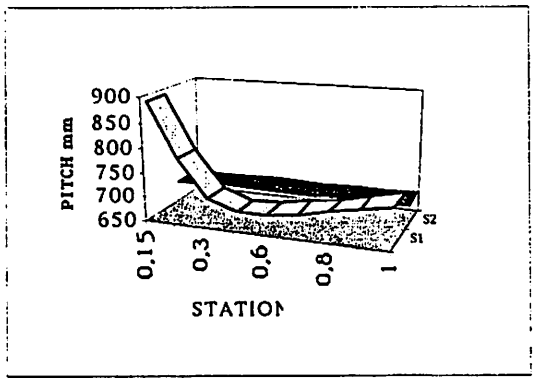


Fig. No 2

11. HOW TO CHANGE PITCH?

We would like to try different angles of attack (= pitch). e.g. 6° and 10°.
From Table No 1 we have the basic blade angle at station 0,7 = 30,9° To this we add the AOA:s, and calculate the corresponding P_{eff}.

P = TAN(30,9° + 6°) * 2 * π * 0,7 * 195 = 644 mm. P/D = 644/390 = 1,65

P = TAN(30,9° + 10°) * 2 * π * 0,7 * 195 = 743 mm. P/D = 743/390 = 1,9

The values for the P/D can also be noted from the nomogram.

WHERE TO LOCATE THE 45° TEMPLATE FOR THE 6° and 10° AOA?

From Table No 2 we read the locations of the 45° template.

6° @ 0,52 x 195 = 101 mm

10° @ 0,6 x 195 = 117 mm

(THE AUTHOR WOULD APPRECIATE IF MORE ACCURATE TEST RESULTS FOR VELOCITY AND RPM COULD BE SUPPLIED BY THE READERS)

52th Indoor Championships Argentina 1998

Santa Fe, National Technological University Stadium

Report by Jorge Conti

Our 1998 National Championship took place in Santa Fe City during August 15,16 and 17. It was organized by the Santa Fe and Paraná Aeromodelling Association. The stadium was aproximately 12 meters high, with some obstacles at the roof, and with some drift in the afternoon which made it impossible to fly F1D on the first day. There were 28 entries in 11 categories, with the special presence of people from Chile. Besides that there were four new national records.

These were the final positions:

ARGENTINE FORMULA

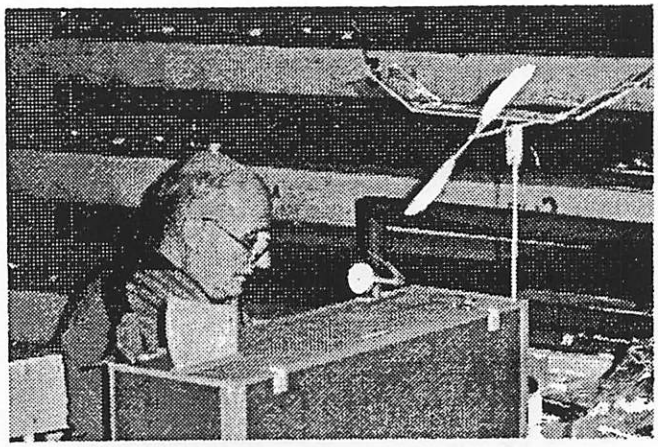
	flight	static	Total
1- Oscar Lastra	210	80	**290**
2- Oscar Lastra	155	80	**235**
3- Marcos Molo	153	65	**218**
4- O. Teló	150	60	**210**
5- O. Teló	142	65	**207**

MIP - Promotional Indoor Model

	sec
1- Oscar Lastra	813
2-Romulo Muñoz	788
3-Julio Cesar Perez	484

MINI STICK

	sec
1- Romulo Muñoz	775
2- Marcos Molo	619
3- Andres Hulais Ferreyra	575
4- Edmundo Cuello	484
5- Eduardo Grippo	356



Eduardo Grippo and EZB-model

EZB/F1L

	sec
1- Romulo Muñoz	1371
2- Edmundo Cuello	850
3- Gabriel Bausela	811
4- Marcos Molo	807
5- Julio César Perez	714

PIR

	sec
1- Marcos Molo	179
2- Daniel Brega	135
3- Rodolfo Boiero	130
4- Eduardo Collaud	126
5- Oscar Navas	120

PATITO (Little Duck)

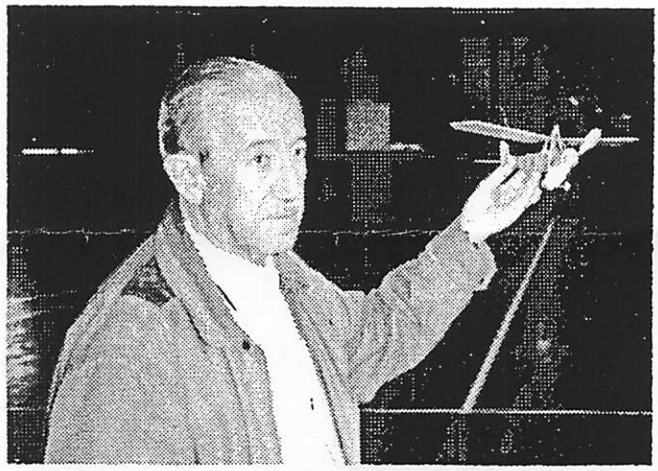
	sec
1-Romulo Muñoz	270
2- Marcos Molo	122
3- Alejandro Taleb	59

LAMI (Hand launch glider)

	sec
1-Martín Bausela	51
2-Julio César Perez	49
3-Rodolfo Boiero	15

F1D

	sec
1- Eduardo Grippo	1282
2- Jorge Conti	1265
3- Edmundo Cuello	832
4- Cesar Perez	360



Romulo Munoz with his Morane Parasol

P25

	sec
1- Romulo Muñoz	463
2- Oscar Lastra	385
3- Gabriel Bausela	361
4- Adriana Martinez	352
5- Oscar Teló	345

PEANUT F4F

	model	static	flight	total
1- Marcos Molo	14 Bis	64	205	1969
2- Romulo Muñoz	Voisin	65	140	1666
3- Marcos Molo	Heinkel 100	62	120	1522
4- Marcos Molo	Halberstadt	60	84	1318
5- Marcos Molo	Civil RV3	66	47	1229

Special Throphy - WEIRD MODEL

1- Marcos Molo	Flying Witch
2- Oscar Lastra	Canard
3- Andres Hulais	Canard
4- Arnoldo Raccchella	Gyrocopter
5- Rodolfo Boiero	Super Stick

Dutch Indoor Championships

Enschede, 20 December 1998

Report by Thedo André

The Dutch Indoor Championships again took place on the Sports Complex of the Twente Technical University, but this time two halls were reserved for the flying. One hall with a ceiling height of about 7m was used for all the junior events and the heavier models. The second hall (9 m ceiling, the one we used in the past), was dedicated to the F1M flying. Most of the competitors arrived the day before and stayed the night in the school of the organising modeling club of the Kottenpark College. The local gym hall was used for trimming and the club's building room in the cellar was the place for last minute repairs and building.

The flying in the "junior hall" was a little bit hampered by the turbulence of the air conditioning, but the kids had a lot of fun. The main events were the (F)looper class, single design Moustique contest, Sainte Formule and the heavily battled Pylon Race. The conditions in Hall 2 were perfect and some very good times were flown. Rainer Lotz from Germany won with a magnificent longest flight of 16'02". I was particularly impressed by his first flight of "only 13 minutes", but the model climbed no higher than about 6 meters! It will take some time before the rest of the world can match the performance of the Germans.

The new format of the Dutch Championships left us all with memories of a most enjoyable weekend. Many thanks to Ebele Schouwstra and his crew.

F1M 6 flew	best 2		total
1. Rainer Lotz	945	962	**1907**
2. Hubert Meulman	752	757	**1509**
3. David Lentink	710	610	**1320**

Sainte Fromule 6 flew	best 2		total
1. Rainer Lotz	246	248	**494**
2. Arjan Saathoff	205	222	**427**
3. Leen de Bruin	180	190	**370**

Moustique 6 flew	best 2		total
1. Philipp Lotz	529	505	**1034**
2. Leon Oude Aarninkhof	294	338	**632**
3. Hugo de Bruin	295	287	**582**

Bostonian 6 flew	best 2		total
1. Philipp Lotz	57	65	**122**
2. Gijs Oosterhuis	46	51	**97**
3. Nick Vissers	48	45	**93**

(F)looper 8 flew	best 2		total
1. Philipp Lotz	129	120	**249**
2. Gijs Oosterhuis	83	97	**180**
3. Nick Vissers	73	66	**139**

Profile Scale 2 flew	flights		static	total
1. Donovan Haneveld	65	57	40	**162**
2. Stefan Pouwelsen	33	40	30	**103**

Pylon Race 8 teams	rounds
1. Homeijer/de Bruin	22
2. ter Horst/ Brendel	13
3. Camfferman/Daniel	10

Finnish F1M Championships 1998

Report by Kai Halsas

The 1998 Finnish F1M Championships took place 21-11-98 at the Loviisa sporting hall. The hall has a ceiling height of 9 m. The results had improved considerably from last year. Last years winning time of 15:30, would now have been good for a seventh place. Five contestants had propellers with variable geometry.

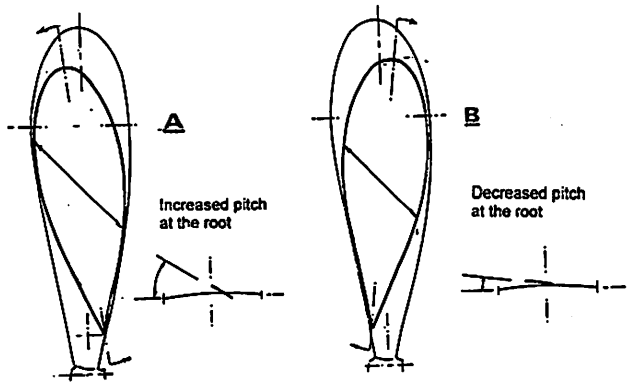
12 Flew	best 2 flights		total
1. Pentti Nore	10:15	10:45	**21:00**
2. Lasse Nyberg (J)	10:32	09:49	**20:21**
3. Harri Raulio	09:22	10:21	**19:43**
4. Tapio Linkosalo	09:36	09:42	**19:18**
5. Janne Laurén (J)	09:30	06:34	**16:04**

Molding a Mini-Stick Propeller

by Jean-Francis Frugoli (FRA)

I herewith present you a method for forming a Living Room/Mini-Stick (or Sainte Formule) propeller which I think is a little more precise than the classic cylinder or beer bottle method and also much quicker than the construction of a built-up propeller jig.

The method is nothing more than using a plastic Peck Polymer propeller (ø180 mm) as the base mold instead of a cylinder or bottle. Both blades are soaked in water and bound on the propeller with paper bandages. The advantage of this method is that you can use a pitch and camber distribution which has already proved itself in practice. An additional refinement is the possibility to change the inclination of the blade with respect to the propeller center line and hence fiddle a bit with the twist at the root of the blade (see illustration).



There is a minor inconvenience in that you must let the blades dry at ambient temperatures, say 48 hours, because it is not possible to put the plastic propeller in an oven or micro-wave. Just start your project with the propeller and while this is drying, build the rest of the airplane!

CP's, AC's and NP's

by Reg Boor (GBR)

PRELIMINARY CONCEPTS

The intention of this article is to try and explain in simple terms the concepts of, and the difference between aerofoil centre of pressure (CP), aerodynamic centre (AC) and complete aircraft neutral point (NP). There is, quite understandably, much confusion between these three points and we shall attempt to clarify the differences without too much mathematics, although I would remind readers that unlike other pleasures in life, mathematics does not damage your health!

The aerodynamic characteristics of aerofoil sections are always given in text books for the "two-dimensional aerofoil" and this concept is perhaps a difficult one, but the aerofoil of a constant chord wing trapped between the walls of a wind tunnel behaves two-dimensionally because of the absence of wingtip effects and this is how tests to validate two-dimensional theoretical characteristics are carried out. Indeed, the only way to compare one aerofoil with another is by means of their two-dimensional characteristics and aerofoil theory is invariably two-dimensional.

We shall only consider positivly cambered aerofoils, ignoring zero and negative camber but mentioning reflex camber and its effect. It is the camber-line of an aerofoil which gives it its fundamental aerodynamic qualities that contribute to the static stability and trim of the aircraft. Without going into the difficult question of how it arises, an aerofoil section generates a pressure field around itself which acts upon the surface at every point at right angles to the local surface at that point. This "pressure distribution" is made-up of that from the camber line, which is of interest to us here, and that from the thickness distribution, which is usually symmetrical about the camber-line and contributes little to the aerodynamic qualities of interest. Therefore, we shall examine the aerodynamic forces arising only from the camber-line and so, without any loss of generality, we might as well examine a camber-line that as indoor flyers interests us greatly, the circular arc.

To be able to continue we need an understanding of the term "pitching moment". When discussing the effects of aerodynamic forces on a body the word "moment" is used in preference to the word "torque" but the meaning of the two words is the same. If we say that a positive pitching moment on an aeroplane or aerofoil is a nose-up aerodynamic torque we have connected the two words and defined the accepted sign convention. Thus, a positive pitching moment tends to increase the angle of attack. Arising from their individual pressure distributions, camber lines possess two major characteristics. The first of these, of most importance for our discussions here, is the zero-lift pitching moment, written Mo and pronounced em-nought. The second is the zero-lift incidence, but as I do not have Greek letters at hand we shall write alphao, pronounced alpha-nought.

THE ZERO-LIFT PITCHING MOMENT

How an aerofoil can have a pitching moment at zero lift may seem to be something of a mystery. But figure (1) will illustrate the mechanism. For positively cambered aerofoils the zero-lift incidence is always negative and for circular arc foils it is given in radian measure simply by multiplying the fractional camber by minus two, if you want it in degrees just multiply the resulting number by 57.3. So in figure (1) we have placed a 5% arc at -2*0.05*57.3 = -5.73 degrees and you will see that because of this angle the front part of the foil carries positive pressures on its upper surface and negative pressures on its lower surface, this is opposite to the usual pattern. The rear of the foil carries the usual pressure pattern of upper surface negative and lower surface positive. Consequently, the forward part of the aerofoil has a total downward force and the rear part an upward force. The result of this pair of forces, which are equal but opposite and technically called a "couple", is zero total resultant force or lift but a nose-down torque, or as we are going to call it, the zero-lift pitching moment, Mo, or Cmo in coefficient form, pronounced see-em-nought. Once again, for the circular arc foil the theoretical value of Cmo is very simple and is -pi*(h/c) where pi=3.142 and (h/c) is the fractional camber as used above. Thus for the 5% foil shown,
Cmo = -3.142*0.05
= -0.1571.

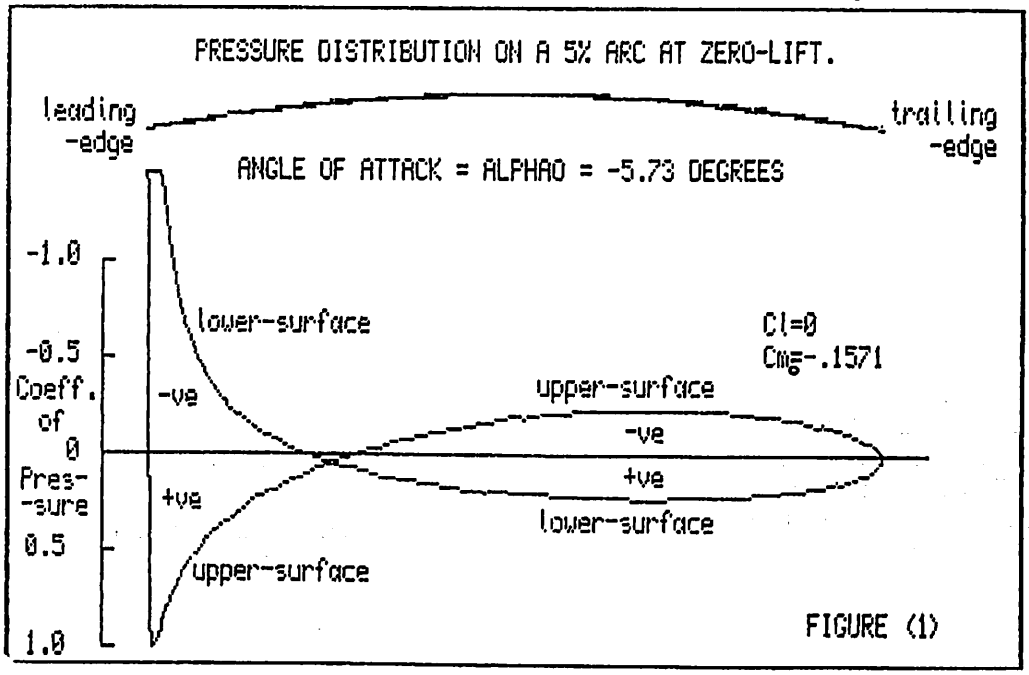


FIGURE (1)

By now you will have realised that, theoretically speaking, the circular arc is most useful because the two major interesting characteristics are simple multiplicative functions of the camber. If you prefer to use sections with the maximum camber elswhere than the half chord point you should get hold of the classic work "Aerofoil Sections" by Abbot and von Doenhoff in which you will find many camber-line characteristics in appendix 2, together with their pressure distributions. If you prefer to calculate Cmo and alphao there is a simple method by Pankhurst on page 72, but beware, the signs are given as positive and should be negative and instead of writing Cmo they write Cm(c/4). Why, will become clear later.

Whilst looking at figure (1) you will have noticed that it is, apparently, plotted the wrong way up. The negative left-hand scale is above the axis and the positive scale below. This is the accepted way of plotting the pressure distribution on an aerofoil which, after all, carries the negative pressures on the upper surface and they are plotted so in order to display the pressures the same way up as you would view the aerofoil. Which is more convenient than having to invert it mentally.

THE CENTRE OF PRESSURE, CP

At any angle of attack greater than the zero-lift incidence, alphao, there is an upward force on the aerofoil generated by the distributed pressures that we have been discussing. The question is where should this resultant force be placed on the chord line. Where does it act ? This question is at the heart of the concept of the centre of pressure. Because all the individual pressures are behind the leading-edge they must cause a moment about it and this moment must be nose-down, which is negative by our definition. We know also that a moment is caused by a force acting at a distance, in our case a lift coefficient acting at a place that we are going to call the centre of pressure and this lift coefficient must be placed so as to give the same effect as the distributed pressures. We shall write an equation:

$Cmle = -CL * Xcp$

This says that the moment coefficient about the leading-edge, Cmle, caused by the distributed pressures, equals minus the lift-coefficient,-CL, multiplied by (written as *) the position of the centre of pressure, Xcp, expressed as a fraction of the chord. Or you can re-arrange the equation to say that Xcp = -Cmle/CL.

So this defines the CP position, Xcp, it is the total aerodynamic moment coefficient from the pressures divided by the CL. If we take moments about Xcp we shall get zero, there is no pitching moment about the CP, a statement that could also be the definition of CP position. At this stage we do not know Cmle so cannot calculate Xcp. We are able calculate the lift coefficient, from the lift-slope, which for two-dimensional foils is 2pi, by multiplying it by the angle of attack in radian measure. However, we seem no nearer being able to calculate the CP position, but our next section will bring it all to life.

THE AERODYNAMIC CENTRE, AC

The general rule about forces and moments is that the total force on a body can be considered to act at any single point on that body providing that a moment is placed at the same point so as to reproduce the overall effect of the applied forces . The new system is then theoretically equivalent to the naturally occurring aerodynamic one but much easier to handle in calculations. The previous paragraph showed how to calculate the moment about the leading-edge, Cmle, and we could replace the effects of the distributed pressures by assuming that both CL and Cmle act at the leading-edge. That we could not, in fact, calculate Cmle is a problem that we shall now overcome by showing that we do not need to! Quite obviously, as we change the angle of attack of our aerofoil we shall change the pitching moment about the leading-edge. But there is a surprising fact about both aerofoils and wings that comes to our rescue. Although we cannot prove it in an article of this nature, there is one point on the chord where the pitching moment does not change with angle of attack despite the movement of the CP and that is the aerodynamic centre. This, in fact, defines the aerodynamic centre position, it is the point on the chord where the pitching moment is constant (NOT zero, note) with changing lift coefficient. For two-dimensional aerofoils it is the quarter chord point and for unswept, straight-tapered wings the quarter mean chord point. Even more useful, the actual pitching moment coefficient at the quarter chord is our old friend Cmo, which we do know how to calculate. Hence its other name Cm(c/4).

The aerodynamic centre, AC, then is the point on the chord where the pitching moment is constant regardless of the value of the lift coefficient and if we assume that the lift acts at that point, together with the appropriate constant pitching moment, Cmo, we get the identical effect AT THAT POINT that we would get from the moving CP. If you need the moment about any other point, say the centre of gravity of the aeroplane, the extra moment of the CL about the new point has to be accounted for. The realisation in the 1920's of the facts of the previous statements was a major breakthrough in stability assessment and relieved designers of the worry of Cp movement, replacing it with the simple concept of aerodynamic centre and

CENTRE OF PRESSURE POSITION RE-VISITED

You will remember that our lack of knowledge of Cmle stopped us finding the CP position. But we now know that we can reproduce the effects of the moving CP by using the AC position together with Cmo. So this is the obvious point at which we should place the CL in our search for Xcp. We can now write:

$Cmle = -CL*Xcp = -CL*0.25 + Cmo$

The first equality is a repeat of our very first equation but we know now that if we say the lift acts at the quarter chord from the leading-edge and add in Cmo we shall get the same answer and doing this gives us our second equality. Now we can use the second pair of these equa-

lities together and form a new and more useful equation for Xcp:

Xcp = 0.25 - Cmo/CL

We can calculate both Cmo and CL and so can now find Xcp for any angle of attack if we wish. Remembering that Cmo is always negative (and minus times minus equals plus) the two terms on the right hand side always add together positively and we see that the centre of pressure is always behind the quarter chord point. It approaches c/4 at very high CL, when the second term becomes small, and moves aft as CL reduces and the second term grows larger, but always positive, remember.

We shall look at the particular case of the circular arc at zero incidence, by which we mean that the chord-line is at zero incidence. To achieve this we have to rotate the foil from its zero-lift angle through the angle alphao, so although the chord line is at zero incidence the angle of attack of the foil is actually positive and equal to minus alphao. Knowing that minus alphao equals +2*(h/c), Cmo equals -pi*(h/c), lift-slope is 2*pi and (h/c)=0.05 we can substitute these into our previous equation and get:

*Xcp=0.25+pi*0.05/(2*pi*2*0.05)=0.5*

Note that the two minus signs in the equation have made a plus ! We have shown that the CP of ANY circular arc aerofoil at zero chord line incidence is at its half chord. If you now look at figure (2) where the pressure distribution is drawn for this case for our 5% foil you can see that the distribution is symmetrical about the half chord, illustrating the theory nicely.

THE NEUTRAL POINT, NP

For an aeroplane to be stable and trimmed for level flight its overall pitching moment has to be zero for trim and have certain characteristics for stability. This cannot be achieved with the positively cambered wing alone wherever it is balanced, for it is either stable but untrimmed or trimmed but unstable. A tailplane is needed. The addition of a tailplane does two things. It gives the whole aircraft a positive Cmo and it ensures that the pitching moment reduces, i.e. is nose-down, if the angle of attack is increased after a disturbance (or vice versa), thus tending to return the aircraft to the initial state. This is the "static stability".

The second of these effects is only realised if the centre of gravity of the aircraft, which is the effective balance point, is in front of the neutral point and the neutral point, you will not be suprised to learn I'm sure, is at that point on the aeroplane where the pitching moment is constant with changes in angle of attack. It is a simple matter to calculate where the NP is from a knowledge of the tailplane size and position and it is always behind the aerodynamic centre of the wing for a tailed aircraft. At zero total aircraft lift, the tailplane or elevator setting angle determines the whole aircraft pitching moment, which is now positive (unlike the wing alone) and gradually rotating the aircraft tail down will reduce the total moment until it becomes zero at some angle of attack which gives us a trimmed lift-coefficient at which the aircraft will fly for that particular tailplane setting. The static stability will ensure a return to this trim after a disturbance. Most of you will know that a reflexed trailing-edge on the wing alone gives a similar effect.

IN CONCLUSION

We have avoided an embarrassing question! Where is the CP at zero-lift ? With CL = zero the second term in our equation for Xcp is infinite, so the CP is a long way behind the trailing-edge to say the least. In fact the CP slips off the trailing-edge at quite reasonable values of CL and suddenly the centre of pressure does not seem quite the physical entity that we thought it was. No wonder aerodynamicists were pleased to welcome the aerodynamic centre which, although initially looking like a mathematical conjuring trick, does have the solid physical basis of a constant pitching moment to give it meaning!

Aerofoils with large values of Cmo have large movements of the CP and high camber, particularly if positioned aft on the chord, gives large Cmo. What this means to us is that more tailplane angle is required to trim Cmo before it can go into trimming the required CL. But aerofoils with low CP movement, such as reflexed sections, tend to have poor maximum CL capabilities. As always, you can't have it both ways.

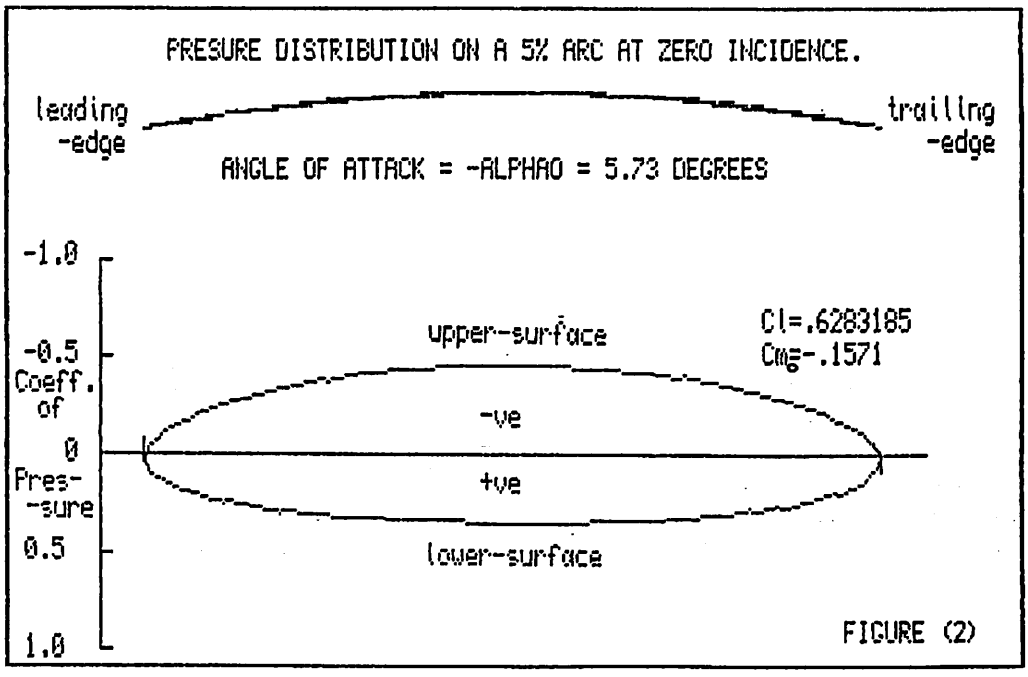


FIGURE (2)

Spanish Indoor Championships

Linares, 6 april 1998

Report by Francisco Jimenez Games

The Spanish Championships were organized by the Club de Aeromodelisme de Linares and sposored by the Federacion Aeronautica Espanola, the Consulate for Sport and Tourism and the Federacion Andaluza de los Deportes Aeros y Exmo. The contest also included the Open Indoor contest of Linares.

The participants at this contest came from Madrid, Valencia and Andalucia, and also, on invitation, one competitor from France, Edmond Roch, one of his country's best F1D-B flyers. Edmond Roch succeeded in securing the first place with two flights of 9 min 34 sec, thanks to his very lightweight models. The contest started at 11.oo hrs in the morning, after a few hours practice, and ended at two o'clock with the pricegiving ceremony. In the class F1D the first place went to Maria Jimenez (a junior). Second place was for Daniel Medina Mangas (10 sec. behind Maria) and third place went to Francisco Jimenez Gamez at only 1 second less. In F1D-B the top three Spanish competitors Juan Moreno Crespo, Luis Fons Bellot and Fernando Haro Martinez gathered enough points for the Spanish Championship, but the Open Championship price went to Edmond Roch. His score was almost twice as high as theirs.

An indoor competition like this is consists of six competition flights, made by model airplanes which weigh between 1 and 3 grams. They are flown indoors to avoid turbulent and drafty air currents which greatly deteriorate the flight performance. At this years competition in Linares the longest flight was 9 min. 54 sec. This is much shorter than the 14 min. which were achieved the year before in June at the Andalusian Championships. The reason for this is the big difference in temperature of 20°C. We are starting to see microfilm covered models, equipped with variable pitch propellers, which will certainly improve the flight times. For the first time we held a competition for Scale models, which was a great success. They were well admired by the public. We hope to see more scale models in Spain in the future because everyone likes them, whether you are a modeler or not.

The venue for the competition was again the Sports Paviljon of Linares in La Garza, made available to us by the Consulate of Sport and Tourism, a place where we have held other great indoor events before. There were a lot of visitors, not only from the neighbourhood, but also from other provinces. We sold all sorts of indoor materials in order to promote our sport. The technical level has risen on every occasion, compared to five years ago by 330%, because in 1993, when we flew in the same paviljon, at the same date and a higher temperature, the best flight was about 3 minutes. This time the best flight was almost 10 minutes, in spite of the poorer air conditions than in the years before.

We believe that the time has come to participate in international competitions. The Federacion Aeronautica Espanola has to support us and form a national team in order to participate at the forthcoming World Championships. This will make up for a fifty year lag in respect to other countries in this particular sport.

The jury consisted of Iluminada Martinez, Fransisco Maza, Jose del Castillo, Fransisco Romero, Raquel de Torres, Gonzalo Rodrigues (Bocal de Aeromodelismo of the Andalusian Federation) and Enrique de Torres took care of the prizegiving ceremony, assisted by delegates from the Tourist Department and the management of the Sports Complex.

F1D 12 flew

1.	Maria Jimenez Martinez	Linares	979
2.	Daniel Medina Mangas	Malaga	969
3.	Francisco Jimenez Gamez	Linares	968
4.	Juan Moreno Crespo	Breguet 19	728
5.	David Lopez Parra	Linares	689

F1D-B 9 flew

1.	Edmond Roch	Paris	1145
2.	Juan Moreno Crespo	Breguet 19	611
3.	Luis Font Bellot	SAF 15	521
4.	Fernando Haro Martinez	SAF 15	447
5.	Jose Cubero Montoro	Linares	399

Scale 9 flew		model	static	flight	total
1.	Daniel Medina Mangas	Pilatus	9	50	59
2.	Juan Moreno Crespa	Volkspl.	9	41	50
3.	Fernando Haro Mnez	Fred	17	28	45
4.	Luis Font Bellos	Fred	19	17	36
5.	Juan Moreno Crespo	Cougar	4	30	34

INDOOR MODEL SUPPLY

INDOOR WOOD PRICES

WORLD CHAPIONSHIP GRADE QUALITY

C Cut for Motor Stick, Tail Cone & Props, 18"
weights are 4.0 & under to 4.5 lb $4.50

THE EMPHASIS IS ON ALL THE CRITERIA OF QUALITY

A or B Cut Spar and Rib Stock .... $3.95 for 18"
Tapered $2.95
Special Length $4.95
Minimum Order on 24" is 5 sheets

GETTING STARTED? LOOK OVER THE PACK DESCRIPTIONS IN THE CAT PG. 17
THESE ARE YOUR BEST BET. PROP WOOD PACKS ARE ALSO USED IN THE CONSTRUCTION OF P-NUTS AND PISTACHIOS THAT REQUIRES THIN C GRAIN.

Minimum Order on INDOOR WOOD $85

GETTING STARTED?

CALL FOR SUGGESTIONS TO LOWER YOUR COSTS

Box 2020, Florence, OR 97439, USA

FORTY MINUTE CLUB

JANUARY 1999

NAME	COUNTRY	TIME	1*	2*	YEAR	SITE
BROWN, STEVE	USA	63:54	X		1996	SANTA ANA
RICHMOND, JIM	USA	56:35	X		1996	AKRON
RANDOLPH, BOB	USA	55:06	X		1993	SANTA ANA
BROWN, STEVE	USA	53:45		X	1997	SANTA ANA
ASLETT, BERNARD	UK	52:22	X		1983	CARDINGTON
UNDERWOOD, GARY	USA	51:58		X	1996	LAKEHURST
ROBBINS, HERB	USA	51:36	X		1998	SANTA ANA
KOWALSKI, DICK	USA	50:41	X		1976	AKRON
DOIG, RICH	USA	50:41		X	1995	AKRON
BANKS, CEZAR	USA	49:50		X	1996	MOSCOW, IDAHO
RICHMOND, JIM	USA	49:44		X	1997	SANTA ANA
ROMAK, BUD	USA	49:35		X	1991	LAKEHURST
RANDOLPH, BOB	USA	49:31		X	1995	AKRON
BARR, LAURIE	UK	49:29		X	1996	CARDINGTON
HUNT, BERNARD	UK	49:07		X	1997	CARDINGTON
COSLICK, LARRY	USA	48:16		X	1997	SANTA ANA
SLUSARCZYK, DON	USA	48:10		X	1995	AKRON
BUTTY, RENE	SWI	48:01		X	1996	MOSCOW, IDAHO
KAGAN, JOHN	USA	47:58		X	1997	SANATA ANA
ROHRBAUGH, AL	USA	47:40	X		1997	AKRON
HARLAN, RAY	USA	47:13		X	1980	AKRON
GIBBS, BOB	USA	47:03		X	1998	SANTA ANA
TIPPER, JOHN	UK	46:45		X	1996	CARDINGTON
DOIG, RICH	USA	46:24	X		1983	AKRON
OTA, KENICHI	JPN	46:16	X		1996	MATUMOTO CITY
LOUCKA, LARRY	USA	46:14		X	1995	AKRON
CHILTON, STAN	USA	46:10		X	1994	AKRON
McGILLIVRAY, JACK	CAN	45:57		X	1996	MOSCOW, IDAHO
RODEMSKY, ERV	USA	45:50	X		1974	SANTA ANA
RIEKE, K. H.	GER	45:40	X		1962	CARDINGTON
MERKT, THOMAS	GER	45:27		X	1996	MOSCOW, IDAHO
REDLIN, CARL	USA	45:17	X		1962	CARDINGTON
REE, ANDRAS	HUN	45:13		X	1998	SLANIC PRAHOVA
ANDREWS, PETE	USA	44:59		X	1979	AKRON
ENOMOTO, HIDEYO	JPN	44:55		X	1998	MATUMOTO CITY
MATHER, CLARENCE	USA	44:44	X		1974	SANTA ANA
ASLETT, BERNARD	UK	44:37		X	1985	CARDINGTON
DE BATTY, BOB	USA	44:35		X	1996	SANTA ANA
NICOARA, VASILE	ROM	44:30		X	1996	MOSCOW, IDAHO
HULBERT, BILL	USA	44:27		X	1994	AKRON
HACKLINGER, MAX	GER	44:20	X		1961	CARDINGTON
NORE, PENTTI	FIN	44:01		X	1986	CARDINGTON
ANDRE, THEDO	NED	44:01		X	1986	CARDINGTON
KOPECKY, ERNIE	USA	43:42	X		1963	SANTA ANA
ROBBINS, HERB	USA	43:39		X	1995	SANTA ANA
ORSOVAI, DEZSO	HUN	43:37		X	1986	CARDINGTON
ALLEN, PAUL	USA	43:36	X		1974	SANTA ANA
KUJAWA, SYLWESTER	POL	43:35		X	1992	WROCLAW
MANGALEA, CORNELIU	ROM	43:30		X	1996	MOSCOW, IDAHO
CUMMINGS, FRANK	USA	43:28	X		1963	SANTA ANA
ATWOOD, BILL	USA	43:17	X		1963	SANTA ANA
THOMAS, MIKE	CAN	43:01		X	1996	MOSCOW, IDAHO
PLOTZKE, RON	USA	42:53	X		1969	LAKEHURST
FOSTER, JOE	USA	42:44		X	1987	SANTA ANA
SIEBENMANN, DIETER	SWI	42:33		X	1986	CARDINGTON
CAILLIAU, LARRY	USA	42:29		X	1985	AKRON
BAILEY, BOB	UK	42:28		X	1998	SLANIC PRAHOVA
DOMINA, DAN	USA	42:25		X	1979	AKRON
CANNIZZO, SAL	USA	42:20		X	1983	LAKEHURST
PYMM, DAVE	UK	42:03		X	1986	CARDINGTON
ROMAK, BUD	USA	42:01	X		1965	MOFFETT NAS
OBARSKI, DICK	USA	41:30		X	1981	AKRON
FINCH, TOM	USA	41:27	X		1963	SANTA ANA
KINOSHITA, SATOSHI	JPN	41:24		X	1993	TACHIKAWA CITY
CHAMPINE, BOB	USA	41:23	X		1963	SANTA ANA
RODEMSKY, ERV	USA	41:23		X	1979	AKRON
STOLL, ED	USA	41:21	X		1963	SANTA ANA
HOFFMAN, EARL	USA	41:13		X	1987	SANTA ANA
KIHARA, KAZUMASA	JPN	41:06		X	1998	MATUMOTO CITY
MATHER, CLARENCE	USA	40:54		X	1974	SANTA ANA
GANSER, RON	USA	40:53	X		1996	AKRON
DRAPER, RON	UK	40:44	X		1962	CARDINGTON
POPA, AUREL	ROM	40:42		X	1996	MOSCOW, IDAHO
BILGRI, JOE	USA	40:37	X		1965	SANTA ANA
NONAKA, SIGEYOSI	JPN	40:36		X	1978	CARDINGTON
STEVENS, DARRYL	USA	40:35		X	1986	SANTA ANA
SHEPHERD, JESSE	USA	40:33		X	1995	AKRON
DIHM, JAN	POL	40:21		X	1997	SLANIC PRAHOVA
LOTZ, RAINER	GER	40:20		X	1996	MOSCOW, IDAHO
GITLOW, LEW	USA	40:15		X	1987	SANTA ANA
MOSKALEV, VASILI	UKR	40:15		X	1996	MOSCOW, IDAHO
KALINA, JIRI	CZE	40:11		X	1975	CARDINGTON
RODENBURG, OTTO	NED	40:11		X	1986	CARDINGTON
TRIOLO, JOHN	USA	40:06	X		1974	LAKEHURST
MZIK, LARRY	USA	40:01		X	1995	AKRON

*CLASS 1 – Over 65 cm CLASS 2 – FAI 65 cm – 1 gram

Official and unofficial flights included (best effort only, by individual, by class is shown).

For additions, corrections, etc. send details to:

BOB GIBBS 22870 Springmist Drive, Moreno Valley, CA 92557 USA

Wing Tips from Canada

Bill Henderson has kindly offered some material from his indoor column in Model Aviation Canada for publication in Indoor News. When John Marett first started this column many years ago he always included a short item called WING TIP, which described a subject specificly aimed at the beginning indoor flyer.

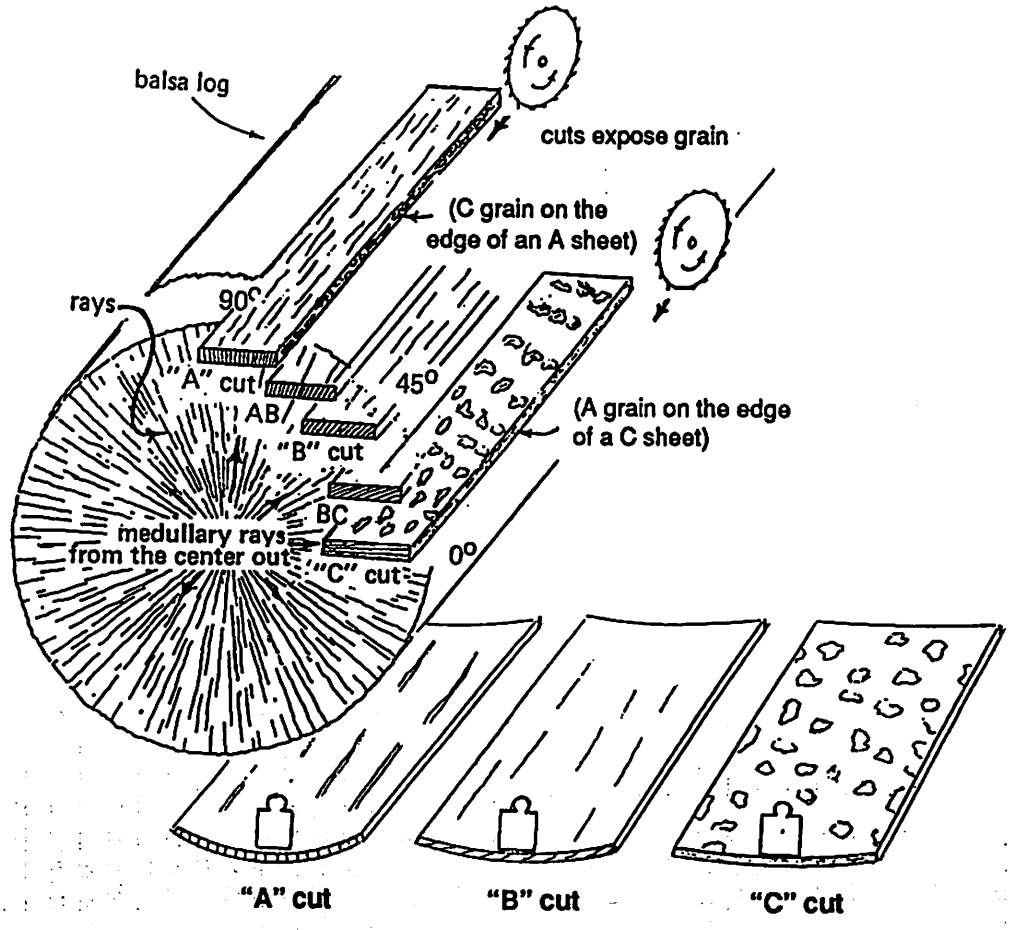
WING TIP

by Bill Henderson (CAN)

The first few Wing Tips are devoted to the materials we use in constructing indoor models and we will start with the main structural material, Balsa wood.

The Balsa tree grows in the tropics, particularly Central America, although it is being colonized in Australia and other suitable climates. It grows very fast and hence is very light, although the range of densities available ranges from 4 to over 20 lb./cu. ft.. The higher densities are used industrially for lightweight, thermal insulation in bulk carriers etc. and for core material in sandwich, structural panels in the transportation industry. In this latter application the material is cut to give panels of end grain wood. Most woods are characterized by their annual rings which gives the characteristic grain texture seen in wood. In Balsa the annual rings are almost impossible to see and instead the grain of balsa is produced by the medullary rays (see diagram). We classify the grain of the wood by the letters A,B, and C and the diagram shows how a Balsa log is cut to give each of the grain types. Each grain type has specific structural properties that makes it useful for particular components in an indoor model.

A grain. Very easy to bend either across the grain or lengthwise, making it the most flexible of all the grain types. Used mainly for spars where sharp bends are needed, such as wing tips, stabilizers, fins and prop outlines. It should not be used for rolled body tubes because it is too flexible.



REACTION TO LOAD

B grain. A mottled, unattractive wood, but stiff for it's weight. Used for straight, stiff spars and can be used, in thin sections, for prop outlines, rudders and stabs. Still not stiff enough for body tubes.

C grain has a mother of pearl look about it. It is very stiff across the grain as well as lengthwise. Very good for rolling tubes and excellent for use in wing and prop ribs. Too brittle for spars.

1999 Indoor Free Flight National Championships

East Tennessee State University, Memorial Center Arena Johnson City, TN

June 2—6, 1999

AMA HQ USE
Type _____
Amount _____
Date _____
Entered by _____

AMA SINCE 1936

Contestant Information:

1. ☐ JR (under 15 as of July 1)
   ☐ SR (from 15 but under 19 on July 1)
   ☐ OP (19 or more as of July 1)
2. Date of Birth _____ 3. AMA # _____
4. Name _____
5. Address _____
   City _____ State ____ Zip _____
6. Day Phone (_____) _____
7. Evening Phone (_____) _____
8. E-mail (if applicable) _____

Fees are a result of AMA and SIG negotiation. Entry forms postmarked after May 3, 1999 must include late registration fee of $15. Requests for refunds must be in writing and postmarked by May 3, 1999. **ABSOLUTELY NO REFUNDS AFTER May 3, 1999.**

FEES:

Entry (1 event)		$ _____
Additional events:	10 X _____ =	$ _____
Late fee if applicable:		$ _____
Site donation (optional):		$ _____
Total Enclosed:		$ _____

☐Check ☐VISA ☐MasterCard Exp. date __/__

Card # _____-_____-_____-_____

Event/Schedule

Wednesday, June 2
Practice Day
7:00 AM to 4:30 PM
☐ 201 HL Stick
☐ 203 F1D
☐ 204 Cabin ROG
* Pro 20
4:30 PM to 10:00 PM

Thursday, June 3
☐ 201 HL Stick
☐ 202 Intermediate Stick
☐ 203 F1D
☐ 204 Cabin ROG
☐ 210 Ornithopter
☐ 212 HL Glider
☐ 214 ROG Stick
☐ 218 Standard Cat. Glider (JS) (O)
☐ 219 Unlimited Cat. Glider (JS) (O)
* Unltd Rubber Speed
* Pro 20

Friday, June 4
☐ 205 Manhattan
☐ 207 Pennyplane

Friday Cont.
☐ 209 Helicopter
☐ 211 Autogiro
☐ 215 Bostonian
* FAC Peanut, * Pistachio, * High Wing Mono, * Pioneer, * Modern Civil Production, * WWI Mass Launch, * Bostonian Mass Launch

Saturday, June 5
☐ 206 Easy B
☐ 505 Peanut Scale
* FAC Scale, * F.R.O.G., * Golden Age, * Coconut Scale, * No-Cal Scale, * Dime Scale, * Legal Eagle, * WWII Mass Launch, * Int. EZ B, * 35 CM

Sunday, June 6
☐ 208 Ltd Penny Plane
☐ 213 Kit Plan Scale
☐ 220 Ministick
☐ 507 Flying Rubber Scale
* F1M (F1DB)

*** Unofficial Events**

Banquet will be Friday, June 4 at 6:30 PM.

Fees:

Open: $25 first event, $10 each additional

Jr/Sr: $10 flat fee (any number of events)

FOR ANY AND ALL EVENTS: I hereby certify that I have read all information accompanying this entry form, and that models entered by me will be built by me (if required) and flown in compliance with the current Competition Regulations or FAI Sporting Code if it applies, and will previously have been successfully flight tested and proved to be airworthy in accordance with the Official AMA Safety Code.

_____ _____
(Applicant's Signature) (AMA Number)

IN CASE OF EMERGENCY PLEASE CONTACT:

NAME _____ Day Phone _____ Relationship _____

Address _____

City, State, Zip _____

APPLICANT CHECK LIST:

☐ Double check and verify correct fees are enclosed
☐ Check(s) signed and payable to AMA
☐ Name, AMA number, and complete address shown
☐ Emergency contact information (above)
☐ Have read all schedule and processing information
All credit card information is given (expiration date, card number, card company)
☐ All events are indicated
☐ No conflict exists in "one only" events, if applicable
☐ Team entry is in compliance with AMA rule book, if applicable
☐ Frequency information, if applicable, is complete and correct
Signature above

Send registration form to AMA Headquarters, 5151 E. Memorial Dr., Muncie, IN 47302. Attn: Competitions Dept.

1999 AMA INDOOR NATIONALS AND THE EIGHTEENTH UNITED STATES INDOOR CHAMPIONSHIPS

"MINI-DOME" - EAST TENNESSEE STATE UNIVERSITY JOHNSON CITY, TENNESSEE

JUNE 2 – JUNE 6, 1999

Send Entry with Check Payable To:

USIC 99, 5432 Haft Rd., Cincinnati, OH 45247

NON-AMA EVENTS REGISTRATION

Name: _____ AMA # _____

Street: _____ JR [ ] SR [ ] OPEN [ ]

City: _____ State _____ ZIP _____ Phone: [ ] _____

I hereby certify that I understand all of the rules under which I will compete and will diligently follow the Official AMA Safety Code as well as any rules that may be established on site and will apply the use of accepted common sense in all my flying and affairs at the contest site.

Signature: _____

FEES:

Basic entry fee includes one event.

Entry fee	$ 10.00	_____
Junior and Senior entry	$ 1.00	_____
Additional events, OPEN	$ 5.00	_____
Additional events Jr & Sr.	$ 1.00	_____
P24 Mass Launch	$ 3.00	_____
WWI and/or WWII Mass Launch	$ 3.00	_____
Banquet (Per Person)	$ 23.00	_____
8' Table & 2 Chairs	$ 16.00	_____
Dormitory cost (See below)		_____
Total Fees	$	_____

MUST BE POSTMARKED BY MAY 22, 1999.
LATE ENTRY FEE OF $10 00 PAYABLE ON SITE
REMINDER: SEPARATE ENTRY FORM FOR AMA EVENTS

DORMITORY COST AT ETSU RESERVATION

Single occ.	$28.50 per night x _____	= $ _____
Double occ.	$28 50 per night x _____	= $ _____
Triple occ.	$42 25 per night x _____	= $ _____

*Please indicate reservation in:

June	1	2	3	4	5	6
Single						
Double						
Triple						

Name of roommate(s) if known: _____

NON-AMA EVENTS
[X] Events entered

[ ] PRO 20 [ ] F1M(F1DB)
[ ] 35 CM [ ] INT. EZ-B
[ ] F.R.O.G.
[ ] NO CAL
[ ] GOLDEN AGE SCALE
[ ] HIGH WING MONO
[ ] UNLIM. RUBBER SPEED
[ ] COCONUT SCALE
[ ] WWI & WWII MASS LAUNCH
[ ] FAC SCALE
[ ] FAC PEANUT
[ ] PIONEER
[ ] MOD CIVIL PRODUCTION
[ ] PISTACHIO SCALE (MIAMI)
[ ] P-24 MASS LAUNCH
[ ] LEGAL EAGLE
[ ] DIME SCALE

BANQUET TO BE HELD FRIDAY JUNE 4, 6:30 P.M. AT THE HOLIDAY INN. (Formerly the Sheraton Plaza.)

In case of emergency, please contact:
Name _____
Street _____
City _____ State ____
Phone: ( ) _____

No linens will be provided, so bring your own sheets, towels, etc. For double and triple occupancy rooms, you must recruit your own roommate(s). Some rooms are with baths and others have adjoining baths (shared). NOTE: A $25 00 fee will be charged for lost or unreturned keys. NO EXCEPTIONS. REBATES WILL BE MADE AS APPROPRIATE ON ROOMS Dormitory housing will be in CARTER HALL.