Harbor Soaring Society
P.O. Box 1673
Costa Mesa, CA 92626

25 USA Bread Wagon 1880s

FIRST CLASS MAIL

WILL CONRAD
9359 SHRIKE AVE
FOUNTAIN VALLEY , CA 92708

HARBOR SOARING SOCIETY

(The Soaring) Society Column

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Vice Pres:	Roger Lowery	(714) 756-9356
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Contest Coord:	George Joy	(714) 556-6385
General Dir:	Ross Thomas	(714) 638-0705
News Letter Ed:	Bob Sliff	(714) 895-1203

"The Oldest Sanctioned Soaring Club In the AMA" Chapter # 128

September 1989 Volume 26 Number 9

September Club Meeting: The September club meeting will be held on Wednesday, September 6, 1989, 7:30 pm at the Consolidated Water District Office, 1965 Placentia Ave., Costa Mesa, Ca. The Monthly club contest will be on the 10th of September, field conditions permitting.

October Club Meeting: The Oct. club meeting will be held on Wednesday, Oct 4, 1989 at 7:30 pm at the Water District Office.

MINUTES OF THE AUGUST 89 MEETING

The meeting was called to order at 7:30 pm by Pres. Chris Hurley.

The Treasurer's report given by Frank Chastler was approved by members present.

1. The minutes of the July meeting were approved as published.

2. New Faces: Brian Germane and Lee Stovall were introduced to the club.

<u>Old Business:</u>

3. George Joy reported on the NATS and added that 6 HSS members brought home 10 trophies.

4. Chuck Hollinger and Bob Sliff provided info on the 7 Cell F3E contest.

5. Frank Chastler will be the chairman of the Field Committee and he provided some info about some maps that were being made to provide the club with what will be happening with the field.

a) Frank gave some information on the new pilot program and has just finished a Paragon to add to the fleet. Frank will also have some original new Hobbi Hawks for around $100.00. The proceeds will go to the new pilot program.

<u>New Business:</u>

6. Steve Hendry mentioned that he can get 27 size deep cycle batteries for $52.00 with warranty.

a) Will Conrad motioned for Steve to purchase 6 batteries for the club. The motioned was approved by the members present.

7. John Lupperger provided some info on the Electrofest in September.

8. Lloyd Weaver has donated to the club some HSS newsletters from the early 60's to about 1974.

9. John Lupperger is building a Cheeta and mentioned that it's a bit hard to build, but it is strong and flies great. He will also have slides of the NATS at the next meeting so PLEASE someone bring a slide projector. (*NOTE* The slides were not finished in time for the September meeting, but will be at the October meeting.)

The meeting was ended at 8:40 pm.

Jared Stalls

From the Editor

Several Topics come to mind:

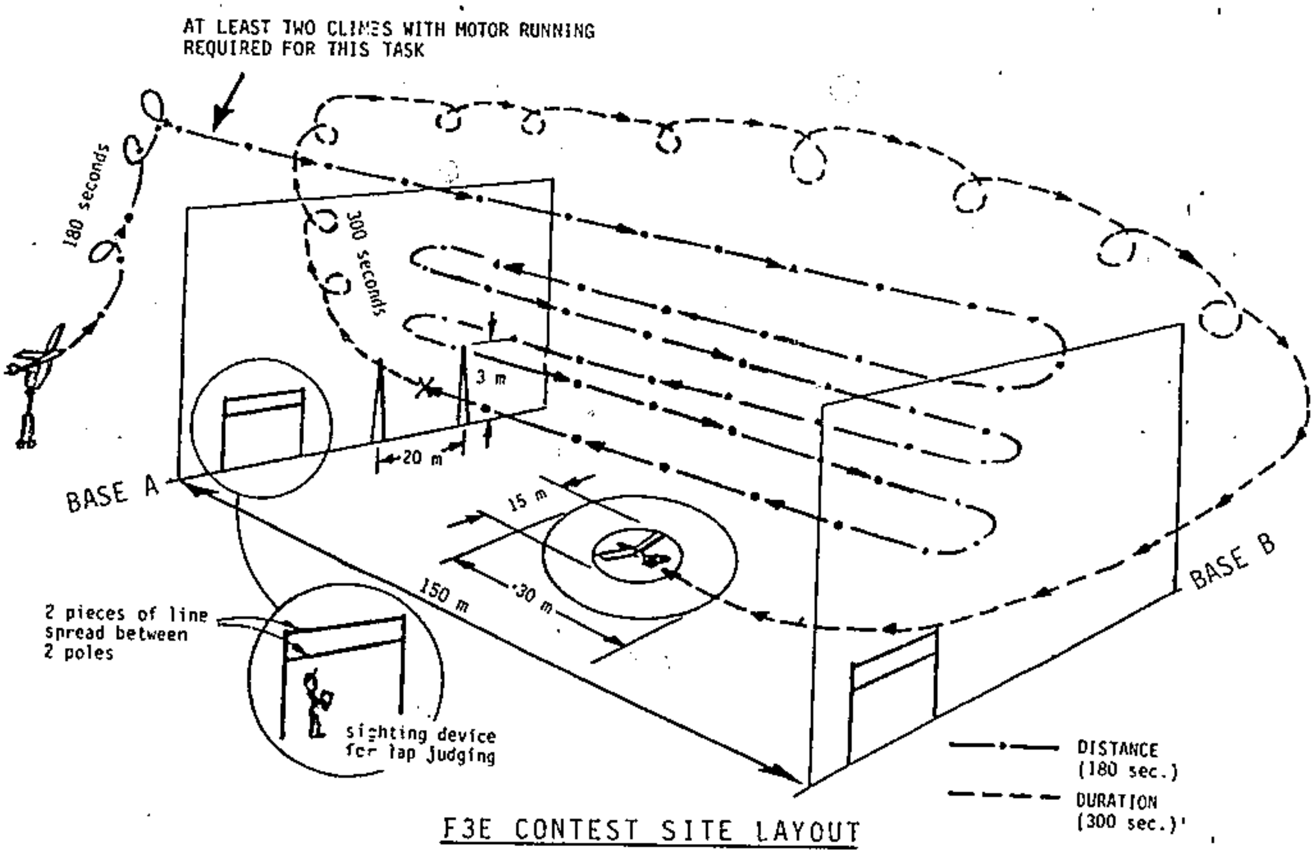
1. I heard from John Lupperger that the Visalia contest filled up immediately. Apparently flyers got the message about the 1 August Post mark for the event director received over 180 entries with the 1st postmark. So they are allowing all who made the date to enter, hoping that some will drop out so they can get close to their usual max of 150 entries. It seems that quite a number of our members made it and will be going. So, let's not forget to bring the banner and get a spot for the canopies.

2. I have heard that the Pasadena SC2 will feature a speed run in addition to some other thermal duration tasks. So, all of you F3B types get set. I guess that some of us who fly the slow floaters will either have to stay home or simply resolve ourselves to a poor placing in the contest. The whole idea doesn't sound fair for a number of SC2 flyers. Of course, you can throw one contest out for the year anyway.

3. The AMA Competitions Department is now asking for bids to host the 1990 F3E Team Selection. We did this last time, and it went off quite well. This time, our Club Contest Coordinator, George Joy has expressed his interest, to me, to CD it. As the time of decision may be very short this year, we should probably consider placing our bid in rather soon. Likely, this can be discussed at the meeting.

4. I wish to express my thanks to Felix Vivas for his fine work in running the 7Cell F3E contest. It was the catylist that got a number of us to work extra hard to perfect models and flying skills that will help us in the future. In behalf of myself and all the ther other flyers/participants, Thank You Felix.

5. I sent in $10.00 to the AMA for the complete set of NATS news letters. In the last issue, #9 (published after the NATS), all of the results are published. As they are too long to include in this newsletter, I will bring them to the next club meeting so you can look them over.



F3E CONTEST SITE LAYOUT

HSS CONTEST DEPARTMENT

George Joy, Contest Coordinator

The following contest schedule is complete to the best of my knowledge.

DAY	MONTH	CONTEST DIRECTOR OR INFORMATION
10	SEP	Bob Sliff (HSS Monthly)
24	SEP	ISS/SWSA SC2
8	OCT	Dave Nemecek (HSS Monthly)
15	OCT	PSS SC2
5	NOV	________(HSS Monthly)
19	NOV	George Joy/Frank Chastler (HSS SC2)
3	DEC	________(HSS Monthly)

Please note the 8th is also the date of the Visalia Contest. So we should consider changing the date as a number of our club members will be attending. I Need CD's for Nov and Dec..

THE SEPTEMBER CLUB CONTEST

Bob Sliff, CD.

TASK--T4. CUMULATIVE DURATION.

3 FLIGHTS FOR 15 MINUTES, NO FLIGHT OVER 7 MINUTES.

WILL USE STANDARD LANDING TAPES FOR LANDING POINTS.

A TARGET TIME WILL BE GIVEN TO EACH CONTESTANT PRIOR TO THE THIRD FLIGHT. (IT WILL BE THE CONTESTANTS RESPONSABILITY TO BE SURE THIS TARGET TIME IS CORRECT--YOU MUST DOUBLE CHECK THE SCORE KEEPERS.)

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The October Contest, Dave Nemecek CD (provided the date can be changed) will be a Standard 3//5//7.

Harbor Soaring Society

August Monthly Contest Results
Open Division

	Name	Actual Score	Normal Score	Class	Trophy
1	MARTIN,T	2,898.1	1,000.0	E	E-1
2	HARRIS,P	2,877.3	992.8	E	E-2
3	FINK,S	2,873.8	991.6	A	E-3
4	CHASTELER,F	2,842.2	980.7	E	
5	HURLEY,C	2,773.3	956.9	E	
6	FINK,D	2,729.4	941.8	E	
7	GIBBS,D	2,725.2	940.3	S	A-1
8	STALLS,J	2,688.7	927.7	A	A-2
9	LUPPERGER,J	2,637.9	910.2	E	
10	GARNER,R	2,632.1	908.2	E	
11	PUCHALSKI,M	2,623.8	905.4	G	
12	BELL,S	2,618.4	903.5	S	S-1
13	LASATER,J	2,543.3	877.6	S	S-2
14	MEIENBERG,K	2,524.4	871.1	E	
15	NEMECEK,D	2,461.5	849.3	A	
16	ZINK,D	2,366.3	816.5	S	
17	SLIFF,B	2,356.5	813.1	E	
18	PANTZAR,D	2,309.3	796.8	E	
19	BRIDGEMAN,J	2,309.3	796.8	A	
20	THOMAS,R	2,303.3	794.8	E	
21	DANRICH,D	2,263.8	781.1	S	
22	LAMPRECHT,D	2,260.1	779.9	E	
23	POULSEN,G	2,205.8	761.1	E	
24	RICHARDSON,P	2,150.6	742.1	E	
25	JOY,G	2,142.6	739.3	E	
26	WHITE,L	2,121.3	732.0	A	
27	BUZOLICH,N	2,019.2	696.7	S	
28	SANDRONI,H	1,994.8	688.3	S	
29	ENGER,L	1,672.6	577.1	E	
30	HENDRY,S	971.3	335.2	S	
31	RITSCHKE,G	900.0	310.5	E	

August Monthly Contest Results
2 Meter Division

	Name	Actual Score	Normal Score
1	LUPPERGER,J	2,882.0	1,000.0
2	STALLS,J	2,872.4	996.7
3	LAMPRECHT,D	2,804.7	973.2
4	JOY,G	2,746.3	952.9
5	THOMAS,R	2,739.3	950.5
6	SLIFF,B	2,710.7	940.6
7	FINK,S	2,619.8	909.0
8	WHITE,L	2,500.0	867.5
9	BELL,S	2,361.7	819.5
10	POULSEN,G	2,309.6	801.4
11	BUZOLICH,N	2,203.3	764.5
12	HURLEY,C	2,116.8	734.5
13	ENGER,L	2,025.4	702.8
14	RICHARDSON,P	1,995.4	692.4
15	LASATER,J	1,302.5	451.9
16	HENDRY,S	1,127.9	391.4

Yearly Standings - Open Division
Through August

	Name	Score	Average	Contests
1	CHASTELER,F	7,709.4	963.7	8
2	MARTIN,T	7,674.0	959.3	8
3	WHITE,L	7,216.5	902.1	8
4	HURLEY,C	7,023.3	877.9	8
5	HARRIS,P	6,946.6	992.4	7
6	PANTZAR,D	6,912.4	864.1	8
7	GARNER,R	6,898.4	862.3	8
8	SLIFF,B	6,628.0	828.5	8
9	LOWERY,R	6,349.4	907.1	7
10	RICHARDSON,P	6,314.1	902.0	7
11	RITSCHKE,G	6,250.1	781.3	8
12	NEMECEK,D	6,054.4	864.9	7
13	THOMAS,R	5,930.1	741.3	8
14	STALLS,J	5,911.7	844.5	7
15	JOY,G	5,115.4	852.6	6
16	CONRAD,W	4,657.7	776.3	6
17	BELL,S	4,655.6	775.9	6
18	HENDRY,S	4,475.1	745.9	6
19	CRON,A	4,425.9	737.7	6
20	POULSEN,G	4,313.7	862.7	5
21	FINK,S	4,213.4	842.7	5
22	LAMPRECHT,D	4,130.2	826.0	5
23	DANRICH,D	4,008.3	801.7	5
24	STOVALL,W	3,915.0	783.0	5
25	LUPPERGER,J	3,710.2	927.6	4
26	SANDRONI,H	3,507.0	701.4	5
27	ZINK,D	3,091.5	772.9	4
28	KUTCH,N	3,057.4	764.4	4
29	RANDOLPH,W	2,526.4	842.1	3
30	SMITH,M	2,327.5	775.8	3
31	CHASTELER,T	1,537.4	768.7	2
32	ENGER,L	1,528.3	764.2	2
33	BUZOLICH,N	1,134.2	567.1	2
34	DEE,M	943.8	943.8	1
35	GIBBS,D	940.3	940.3	1
36	HALL,H	909.5	909.5	1
37	LASATER,J	877.6	877.6	1
38	LEE,T	818.6	818.6	1
39	BRIDGEMAN, J	796.8	796.8	1
40	QUISENBERRY, J	689.2	689.2	1
41	EGOLF, D	686.8	686.8	1
42	WEBSTER, D	599.2	599.2	1
43	WENTWORTH,C	552.4	552.4	1

Yearly Standings - 2 Meter Division
Through August

	Name	Score	Average	Contests
1	WHITE,L	7,456.4	932.1	8
2	SLIFF,B	7,200.3	900.0	8
3	THOMAS,R	7,180.4	897.6	8
4	HURLEY,C	7,180.0	897.5	8
5	CONRAD,W	5,138.8	856.5	6
6	BELL,S	5,130.6	855.1	6
7	JOY,G	5,061.4	843.6	6
8	LAMPRECHT,D	4,790.1	958.0	5
9	POULSEN,G	4,386.7	877.3	5
10	STALLS,J	4,330.1	866.0	5
11	LUPPERGER,J	3,546.1	886.5	4
12	HALL,H	3,503.5	875.9	4
13	KUTCH,N	2,752.5	688.1	4
14	FINK,S	2,396.1	798.7	3
15	LOWERY,R	1,672.3	836.2	2
16	CRON,A	1,270.2	635.1	2
17	LASATER,J	971.9	486.0	2
18	QUISENBERRY,J	868.7	868.7	1
19	ZINK,D	814.1	814.1	1
20	BUZOLICH,N	764.5	764.5	1
21	FINK,D	704.6	704.6	1
22	ENGER,L	702.8	702.8	1
23	RICHARDSON,P	692.4	692.4	1
24	HENDRY,S	391.4	391.4	1

F3E//7 CELL

Second Biannual Contest

19-20 August 1989

Harbor Soaring Society, Costa Mesa, CA

Report by Bob Sliff

Once again, Mr. Felix Vivas has offered the challenge to those of us who would like to improve our knowledge and abilities in the area of FAI style Electric Soaring. With $1000.00 for first prize and $600.00 for second, the carrot was dangled in front of us to urge us on to advance the technology of electric powered models. Jason Perrin and myself enlisted the able assistance of Jerry Bridgman, the first place winner of two years ago and team member of the USA 1988 F3E Team.

I believe we did accomplish much in regards to the aircraft and the flying of them.

Our main emphasis was on the models and on propeller/motor combinations. As to the latter, we really did not use any exotic systems/motors, but used basically stock FAI (6 turn) Astro Cobalt "05" motors with reworked K&W (which, I am sorry to say, is no longer available) 9 X 6 folding props. With a good amount of sanding and shaping of the 9 X 6 along with adapting the blades to a smaller hub (giving a final diameter of 8 1/4") we were able to time the Astro motors to best performance giving us RPMs of about 12,500 at close to 35 Amps draw. This in turn gave us a motor run time in excess of a minute and forty five seconds.

The Aircraft was an even more important ingredient. Having seen the European flyers at last year's World Champs in St. Louis, MO., we had a good idea of what was really necessary to make the airplanes superior. The St. Louis experience showed that the prime ingredient was weight--the lighter the better. Add to that a clean design, and the rest will take care of itself. Through the judicious use of Kevlar, Glass, and Carbon Fiber, the final weights of the completed models were near 34 oz. Add to this a fast airfoil, the RG12A, (See SOARTECH #6, March 1987, pages 90-99) and you have a model with excellent capability.

Of course, there is one last ingredient. That is the flyer. With Jerry's excellent guidance, Jason and myself spent several weeks practicing flying the event. Even though we didn't have the final models until a week before the event, practice on inferior models made us work hard enough that when we started to fly the final designs, adapting to their increased performance came rather easily. Then, it was basic flying ability in the distance portion that placed us in our final positions.

The event itself is rather interesting in that it challenges the flyer to both fly fast, as well as fly "thermal" duration all in the same flight. The first part challenges one to go fast, as you have three minutes to complete as many 150 meter laps as you can. Since laps can only be done with the motor off, you must climb to gliding altitude, make laps, climb again, and make more laps. You climb and glide as much as needed to make all the laps you can before the three minutes is up.

Next, while remaining airborne, the model must make a low pass through a gate area at an altitude below 3 meters. This starts you on the duration part of the event. From here you may use your motor as often as you wish to allow you to make a duration flight of five minutes. Here, the motor run is basically deducted from you total gliding time. The answer is "make the time" in whatever way you can. If you can find a thermal with little or no motor, great, but if not you must have enough motor run available to stay up until the end of the five minutes.

Last, but not least, you try to land inside a circle for either 30 points or 15 points with one circle inside the other. The inside circle (15 meters diameter) is worth 30 points while the outside circle area (30 meters diameter) is worth 15 points.

Putting all this together, you get the score for one round. And after several rounds (seven in this case), and with the one lowest round dropped, you get the final score. So, this is how they stacked up.

(FORMAT: contestant name by final finish position followed by round score and number of laps that round. Final score is after lowest round is dropped.)

CONTESTANT	1	2	3	4	5	6	7	TOTAL
JASON PERRIN	508/14	517/15	515/15	541/16	538/16	539/16	527/15	3177
BOB SLIFF	508/14	521/14	523/14	483/13	504/13	497/13	493/13	3046
MATT POELKING	390/11	450/12	453/11	368/11	463/11	462/10	518/14	2736
JARED STALLS	377/10	446/11	409/09	474/12	491/12	419/12	480/12	2719
HATCH MANNELL	428/12	411/10	447/10	482/12	425/11	427/10	396/10	2620
JIM SKINNER	291/10	430/10	389/08	432/08	466/11	460/10	432/10	2609
D. LAMPRECHT	199/07	308/10	437/09	429/09	456/10	457/10	402/09	2489
TOM COPP	284/06	289/08	416/09	388/07	451/12	458/10	450/10	2452
L.NORENBERG	282/09	416/08	396/09	360/06	425/10	455/12	90/06	2334
J. LUPPERGER	299/09	312/09	454/10	302/10	473/11	460/11	230/07	2300
KEN MYERS	303/07	380/08	161/07	373/06	125/05	000/00	000/00	1342
G. WESTLAND	426/10	404/09	000/00	000/00	000/00	000/00	000/00	830
S. MCKENZIE	127/04	322/04	067/04	000/00	000/00	000/00	000/00	516

So there you have the essence of the event. While this was only for 7 cell models, it is a good introduction to the international/world class event with 27 or 28 cells and motors like the Astro 60. We hope to have more events of this type in the future in our area. Why not give it a try in your own area. For details, see the current FAI rule book for 1989 available from AMA headquarters. Also, I would recommend you look into the coming 1990 Team Selection Program. AMA HQ can give you information on this.

SOUTHERN CALIFORNIA SOARING CLUBS
RESULTS OF TOSS (SC)2 CONTEST OF 08/27/89
CONTEST DIRECTOR - MILES MORAN

PL.	NAME	CLUB	CLASS	SCORE	NORM.	TROPHY
1	WURTS, JOE	TOSS	EXPERT	2978.6	1000.0	E - 1
2	OLDENBERG, ED	TOSS	EXPERT	2954.3	991.8	E - 2
3	KOPLAN, TERRY	TOSS	EXPERT	2948.6	989.9	E - 3
4	FINK, DAN	SULA	EXPERT	2898.5	973.1	E - 4
5	MATSUMOTO, BEN	PSS	EXPERT	2888.7	969.8	E - 5
6	NORTHERN, DON	TOSS	SPORTS	2881.7	967.5	S - 1
7	SPENCER, RANDY	SULA	EXPERT	2875.7	965.5	
8	HENDRICKSON, ERIC	TOSS	EXPERT	2870.0	963.5	
9	OLSEN, PETE	SWSA	SPORTS	2859.7	960.1	S - 2
10	MORAN, MILES	TOSS	EXPERT	2857.8	959.4	
11	SLIFF, BOB	HSS	EXPERT	2855.1	958.5	
12	STALLS, JARED	HSS	EXPERT	2829.5	949.9	
13	STARK, TONI	PSS	EXPERT	2814.0	944.7	
14	GARNER, RICH	HSS	EXPERT	2802.7	940.9	
15	CRON, AL	HSS	EXPERT	2748.3	922.7	
16	CHASTLER, FRANK	HSS	EXPERT	2730.4	916.7	
17	ZINK, DON	HSS	SPORTS	2713.3	910.9	S - 3
18	McNAMEE, ART	TOSS	SPORTS	2710.0	909.8	
19	JOY, GEORGE	HSS	EXPERT	2704.3	907.9	
20	McNAMEE, DON	TOSS	SPORTS	2676.6	898.6	
21	RICHARDSON, PETE	HSS	EXPERT	2657.9	892.3	
22	MARTIN, TONY	HSS	EXPERT	2617.6	878.8	
23	SANDRONI, HUGO	SULA	SPORTS	2594.8	871.1	
24	JENKINS, HARVEY	SWSA	SPORTS	2575.6	864.7	
25	HENDRY, STEVE	HSS	SPORTS	2511.4	843.1	
26	RATNER, MIKE	PSS	SPORTS	2502.1	840.0	
27	HOLLEY, MARY	SWSA	SPORTS	2473.8	830.5	
28	OLSEN, ROBIN	SWSA	SPORTS	2462.7	826.8	
29	GOLDSMITH, BOB	TOSS	SPORTS	2443.3	820.3	
30	PROVIN, KURT	SULA	EXPERT	2422.3	813.2	
31	LASATER, JOHN	HSS	SPORTS	2402.7	806.7	
32	CHASTLER, TOM	HSS	EXPERT	2264.2	760.2	
33	KUTCH, NORM	HSS	SPORTS	2250.1	755.4	
34	MEIENBERG, KEN	SULA	EXPERT	2241.7	752.6	
35	FARLESS, DAVID	PSS	EXPERT	1797.3	603.4	
36	PARRA, JERRY	TOSS	SPORTS	859.4	288.5	
37	BUZOLICH, NICK	HSS	SPORTS	649.0	217.9	

TEAM SCORES

TOSS 10	HSS 14	SULA 5	SWSA 4	PSS 4
1000.0	958.5	973.1	960.1	969.8
991.8	949.9	965.5	864.7	994.7
989.9	940.9	871.1	830.5	840.0
967.5	922.7	813.2	826.8	603.4
3949.2	3772.0	3622.9	3482.1	3357.9

ISS/SWSA SCSC

SEPTEMBER 24, 1989

INLAND SOARING SOCIETY

CD Marc Higginbotham (714) 882-7384

Standard SCSC Contest 3-5-7 pilots choice

Scoring: 700/300, 800/200, 900/100
Landings: standard 25' tape

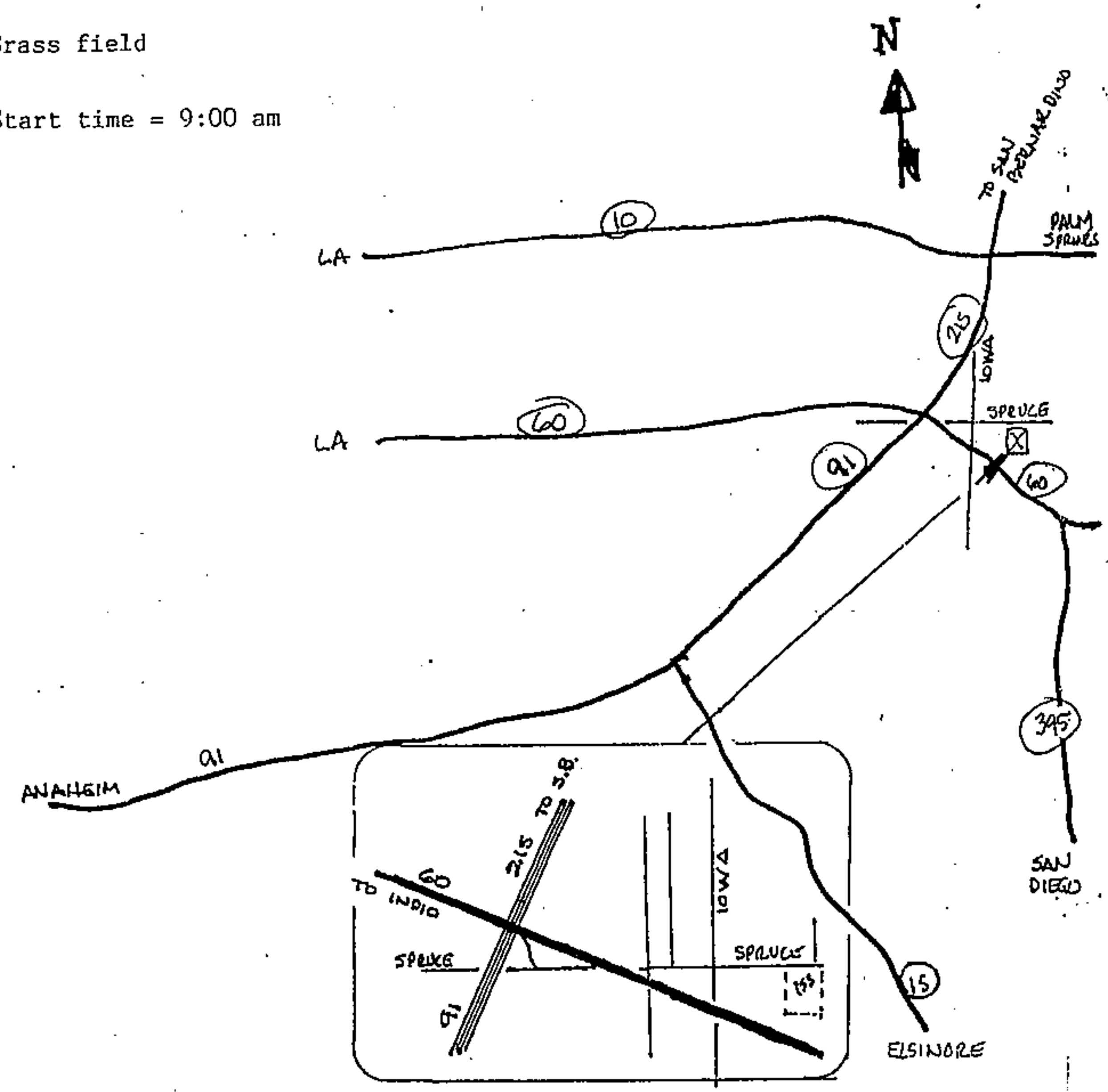
AMA Sanctioned contest.

Entry fee: $6.00

12 volt winches

Grass field

Start time = 9:00 am



COMPARISON OF SOME FLAPPED EPPLER AIRFOILS

by Hewitt Phillips

Abstracted from Soar Tech
Nov. 1983 Vol. 2

The design of an airfoil for a model soaring glider is a compromise between low-speed and high-speed performance. At the low-speed end of the speed range, a high maximum lift coefficient is desired for good high launches and a high value of $C_L^{3/2}$ C_D is desired for minimum sinking speed in thermal soaring. At high flight speeds, a low value of drag coefficient at lift coefficients approaching zero is desired.

It is known that down-flap deflections can improve the performance of some airfoils at high lift, and up-flap deflections can be beneficial at low lift. In effect, the nose portion of the airfoil is kept in closer alignment with the approaching air flow by the use of flaps. The flow tends to separate at the flap hinge line, however, if excessive flap deflections are used. If low drag is required, the lap deflection must be kept small.

Because of the complication of a flap installation, a knowledge of the benefits obtainable as compared to an unflapped airfoil is required. For this reason, analytical studies have been made on three commonly used Eppler airfoils to show the effects of plus or minus 5 degrees deflections of a 20% chord flap. The flap deflection was limited to plus or minus 5 degrees to avoid drag increases due to flow separation at the flap hinge line.

These studies are made using the Eppler airfoil program, the same program which was to design the basic airfoils. In the original design of the airfoils, the pressure distribution is specified and the resulting airfoil is determined. This procedure employs the design mode. In order to study the effect of flap deflections, however, the airfoil coordinates must be specified and the resulting pressure distribution determined. This procedure employs the analysis mode. The use of the analysis mode introduces slight irregularities in the pressure distribution which results in a small drag increase as compared to the design mode. In this study, in order for all drag values to be comparable, the analysis mode is used to obtain the drag polars of the basic airfoils as well as those for the airfoils with deflected flaps. The drag polars of the basic airfoils were originally determined by Eppler using the design mode. The drag values presented herein may, therefore, be slightly higher than values published previously for the same airfoils.

The airfoils studied are the Eppler 205, 211, and 214. As found in the book of Eppler Airfoils, the drag polars of the basic airfoils are plotted, along with curves for 5 degrees down-flap deflection at high lift and for 5 degrees up-flap deflection at low lift. All these results are at a Reynolds number of 150000.

The results show that the Eppler 205 airfoil with 5 degrees up-flap deflection has the lowest drag at zero lift. The 214 airfoil does not maintain low drag down to zero lift even with 5 degrees up-flap deflection. At high lift, the 214 airfoil with 5 degrees down-flap deflection is clearly superior to the other two airfoils.

These results may serve as a guide to airfoil selection, but the limitations of the study must be kept in mind. The theory shows that the results are sensitive to slight changes in airfoil contour, smaller than can be achieved with practical model construction. The results obtained in real life are also affected by separation bubbles which are accounted for in the theory in a rather approximate way. The results shown apply only to a Reynolds number of 150000. In flight, the Reynolds number usually varies from a value smaller than this at the stalls to a value much larger in a dive.

The efficiency of all three airfoils may be expected to improve about equally with increased Reynolds number. The ability of the 205 or 211 airfoils to maintain low drag down to zero lift with 5 degrees up-flap deflection indicates that these airfoils are suitable for speed events, but all three airfoils are equally good at the speeds usually used for wind penetration. The 214 airfoil with 5 degrees down-flap shows superior characteristics for the launch and thermalling regimes.

LATERAL-DIRECTIONAL STABILITY OF MODEL SAILPLANES

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One of the most difficult problems encountered in sailplanes design is lateral-directional stability when using rudder only for directional control. Low speed control for thermalling and landing requires an effective rudder coupled with a relatively large dihedral angle. Unfortunately, excessive rudder area and/or dihedral angle can lead to high speed lateral-directional dynamic instabilities such as dutch roll, fishtailing, or snaking as well as making the rudder too sensitive at high speeds. Therefore, rudder area and dihedral angle must be a compromise with the low speed control requirements usually being the controlling factor.

It is not my intent to write a complete article on directional stability. Eric Lister has already done a better job in a series of articles for Sailplane back in 1972 and later included in his Sailplane Designers Handbook (Ref. 1). Therefore, those desiring more information are referred to Lister's book, and chapters 8 and 9 of Ref. 2. Since Lister's book is more generally available and is written for the average modeler, I will stick to his nomenclature.

In the November 1972 issue of Sailplane, Lister presented static directional stability data in the form of sideslip instability factor (SIF) for several successful sailplanes of the 1970-71 period. He plotted equivalent dihedral angle versus SIF and found that all models fell within a parallelogram. I calculated the SIF for several successful sailplanes of more recent vintage and plotted them for comparison. Most of these, except for the Sailaire and Viking, fall near a straight line parallel to but above the parallelogram. These data show that we are now flying with more control power in order to get more maneuverability at low speeds.

This increased control is not free and we are paying for it with touchy models that fly closer dynamic instabilities at high speeds. For example, both the Aquila and the original Sailaire exhibit fishtailing at high speeds when the rudder linkage is sloppy or too flexible. A popular fix for Aquila is to increase the rudder chord in order to reduce the amount of aerodynamic balance, however more rigid pushrods and elimination of slop in the linkage will usually suffice. I am familiar with two modifications to the Sailaire that have been used to eliminate high speed instabilities. First, Tom Williams (the designer) shortened the tail boom by 4" and designed a new rudder with a vertical hinge line. This was the version used by Jim Fitch to win the 1978 Nats. Jim's father, Clark Fitch, flies another modification to the Sailaire which was designed and built by Chet Tuthill. Chet lengthened the tail and installed a smaller fin and rudder coupled with a reduction in dihedral angle also eliminated the high speed directional instability problem.

The modified Cirrus developed and flown by Clark and Jim Fitch between 1972 and 1977 provides a good example of the evolution of sailplane lateral-directional control requirements over the last 10 years. The primary modifications were to add polyhedral and to increase total dihedral until satisfactory low speed handling qualities were achieved. It is interesting to note that the final version of this pre-1970 design wound up on the modern curve of dihedral angle versus SIF. Chet Tuthill's latest version of his Dreamer also provides an example of how lateral-directional handling qualities can be adjusted to meet individual requirements. The current Dreamer was originally designed with a low dihedral angle and differential wing tip spoilers for low speed roll control. The tip spoilers were later deactivated and the total dihedral angle progressively increased until satisfactory low speed handling qualities were achieved. Note that the latest Dreamer also falls on the modern curve.

Now, let's take a look at the Viking. The Viking has almost the same directional stability characteristics and dihedral angle as the original Sailaire. Therefore, I would expect the Viking to have the same high speed instabilities. Apparently it doesn't since several were flown and did quite well in the 1978 FAI team selection program where speed was one of the events. Obviously, there is more to the problem than is shown in a simple plot of dihedral angle versus SIF.

Finally, we have Dave Thornberg's Bird of Time. According to Dave's articles in Model Builder, he doesn't think that calculating stability parameters means much for models. You might say that he prefers to style his models rather than engineer them. Dave also likes to style his models with weird shapes that make it difficult to calculate stability parameters. Note that the Bird of Time still falls near the modern curve for SIF. Whether styled or engineered, the Bird of Time is still a winner and that's what counts.

Most modelers adjust the pitch characteristics to suit their own requirements by shifting the center of gravity forward or aft. In data presented it shows that the lateral-directional stability characteristics can also be adjusted by modifying dihedral angle and/or rudder area. Rudder deflection angles over 30 degrees produce mostly drag and should not be used. Therefore, if increased low speed directional control is required and maximum rudder deflection is already 30 degrees, increase rudder area and/or dihedral angle. If high speed lateral-directional instabilities are a problem, first eliminate all possible control linkage slop and increase pushrod stiffness. If the rudder has a relatively large area ahead of the hinge line, reduce the amount of aerodynamic balance by removing area ahead of the hinge line or adding area aft of the hinge line. If this does not solve the problem, then reduce dihedral angle and/or rudder area.

REFERENCES

1. Lister,E. Sailplane Designer's Handbook, published by author.
410 Regina Dr., Clarksburg, MD 20734.

2. Perkins, C.D., Hage R.E. Airplane Performance Stability and Control. John Wiley and Sons.
New York, NY.