THE

SCATER

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THERMALS, ANYONE?

For better or for worse we free flighters are stuck with that great enigma, the thermal. Back in the 30's nobody worried very much about them since little things like starting that balky Brown or tying knots in that lazy brown rubber, were the big problems of the day. Then in the 40's WW II came along and we didn't have too much time to worry about thermals. In the 50's everybody sprouted dethermalizers and talked knowingly of "dead air time". The ultimate model design was still being looked for. Team selection trials were being held in pre-dawn darkness although everyone was still hoping to luck into some good air.

Many voices were raised in angry denunciation of the thermal. In fact for awhile the great thinkers who make up the FAI rules figured you could eliminate thermal luck by cutting rubber weight, towline length, and engine run while also raising wing loading. All that nonsense is over for awhile.

Here in the 60's a new philosophy has evolved. Now the search for the thermal has become a fully recognized part of the contest. It is no longer considered "unsportsmanlike" to look for a thermal. In fact out of necessity it has become a very interesting, challenging part of the sport.

A considerable amount of stuff has been written about thermals. And a lot of it has been challenged as inaccurate and just plain wrong. Just about the only thing we know for sure about them is that a thermal will make a model gain altitude (If you don't spin out).

Therefore whenever anyone runs into information on thermals it might help to take a look at it. Just don't accept it all at face value.

THERMALS

A paper titled "Atmospheric convection; the structure of thermals below cloud-base" by A. H. Yates of the College of Aeronautics, Cranfield, England appeared in the Quarterly Journal of the Royal Meteorlogical Society 79, 1953. Yates has some interesting discussions here although some of his

quantitative data is certainly questionable without any direct experimental verification. In any case thought you might be interested in some of this material.

(a) Thermal size

"A glider pilot is able to circle his glider at an airspeed of 45 mph with 30° of bank, and the circle diam. is then about 430 ft. He finds thermals above about 1000 ft. from the ground allow him to perform his circles entirely in rising air so that, although thermals may be small below 1000 ft. they are of the order of 1000 ft. across above that height and may reach 3-4000 ft. across higher up, although they do not always increase in diam.

(b) Vertical velocity

The rate of climb of the glider is equal to the vertical velocity of the thermal less the rate of sink of the glider in still air. The latter is known to be about 3 ft./sec. so that the vertical velocity of the thermal is easily measured.

It is found that maximum strengths of thermals vary from almost zero on a dull day to 15 ft./sec. on a "good" day and that inside cloud the strength is often greater. The strength appears to be fairly uniform within the thermal and seems to vary directly as the ground temperature on any one day; i.e. it is a maximum in the middle of a hot summer's day.

A negative vertical velocity, i.e. a sink is often found in the neighborhood of thermals, but is not normally so strong as the upcurrent-nor is it very widespread. The downcurrent often rings the upcurrent, the boundary being a region of turbulence. There is not much evidence that the upcurrent strength varies with time.

(c) Temperature

The available evidence is that the thermal is one or two degrees Centigrade warmer than the surrounding air at all heights. At about the height at which the atmospheric lapse rate becomes less than the dry-adiabotic rate, the thermal stops, unless the air has by then become saturated and formed cloud. In summer, many thermals rise to an inversion level and then stop, penetrating only a few feet through the haze.

(d) Periodicity of thermals at one site

The thermal frequency is found to depend on the type of soil, wind, strength and sun angle and, typically, a sizable thermal is released from this area every 5 to 15 minutes. Indications of its release are given by swings of the wind sock, a change in the windspeed, dust devils, etc.

Thermal "model"

What has been described so far is a bubble of hot air with a wake of less warm air moving upward at a slower speed than the bubble. (Fig. 1.)

about 6 X 10^8 ft^3 K which would be just enough to form a 1000 ft bubble. This means that 1000 ft. bubbles are not likely to leave the lower layers of the atmosphere more closely spaced than about a half-mile apart (no wind). The frequency with which thermals are released from a given area depends on the rate at which heat is supplied to the lower layers of the atmosphere and this depends on the suns strength and type of ground.

The process by which the ground layer rises to form the large bubbles is not at all clear. If we assume that small bubbles, say 10 ft. diam. are torn from the ground layer by some disturbance (arm waving?), they will rise rather slowly because of their small diam. They will be eroded like any other bubble and mix with the surrounding air to form a warm wake. The entrainment of surrounding air will encourage other small bubbles rising close by to enter the rising wake and thus to join forces with the first bubble. In this way bubbles rapidly grow and we can envisage in this way the 1000 ft. bubble being formed by the time the top has reached about 1500 ft. Thermals found below about 1000 ft. are thus liable to be small and weaker than those found higher up, and this is broadly in line with glider experience.

The warm wake will enable later thermals to take the same path as the first with less wastage, since the environment is not only warmer than the free air but is already moving upwards.

In this way the leading bubble is constantly reinforced or replaced by succeeding bubbles and the thermal is able to climb higher and higher, past the condensation level until it forms a cumulus cloud.

The reaction felt by the glider approaching the thermal will depend on the stage of development of the thermal. The first effects felt will be those outside the bubble. A rising bubble will push air ahead of it and outwards and downwards in all directions beside it. If the glider enters at A the airflow due to the bubble will tend to increase the apparent airspeed of the glider and a slight downcurrent may also be encountered. The rate of climb will increase sharply after passing through a narrow belt of turbulent air. (wing rocking) If on the other hand, the glider enters at B, the preliminary downcurrent will be well marked, the turbulent zone wider, and the upcurrent less sharp edged.

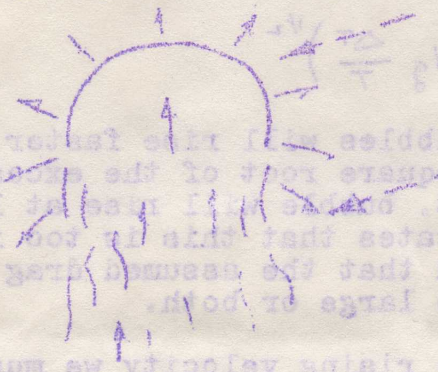
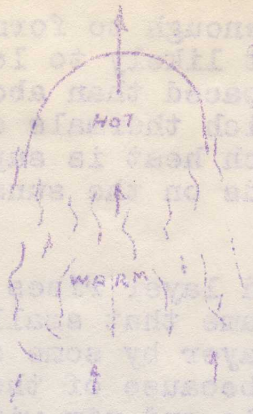


Fig 2

Because of the ratio of wind velocity to upcurrent, the actual path of the bubble will be inclined to the horizontal at an angle of say 30°. However in the absence of wind shear the rising column will be vertical. Only with the existence of wind shear will the rising column "lean". The wind shear is a function of wind velocity and the "dragginess" of the terrain.

Another result of the wind shear is that the rising bubble



If the bubble had a skin (like a balloon) or a definite boundary (such as is provided for an air bubble in water by surface tension) the wake would be a region of turbulent air formed by the separation of the boundary layer near the maximum cross-section of the hot-air bubble. The wake pattern and the drag associated with it have been thoroughly studied in wind tunnels. A bubble of hot air has, however, no skin and the wake will thus be augmented by warm air obtained by the constant erosion of the hot-air bubble by the cold air of the environment. As the column proceeds upward, therefore, the hot bubble is gradually eroded and its heat distributed to the air entrained from the atmosphere. The buoyancy which has been maintaining the vertical motion is ultimately greatly reduced and the column slows unless a further supply of hot air is received from below.

The buoyancy of a bubble of hot air is equal to:

$$F_1 = \text{volume} \times \text{density} \times \frac{\text{temperature excess}}{\text{absolute temp.}}$$

The drag force can be estimated as a first approx. by assuming that of a sphere (i.e. about 0.5)

The drag force is then $F_D = 0.5 \times \frac{1}{2}\rho V^2 \frac{\pi d^2}{4}$

The steady upward velocity of the bubble is then given by:

$$V = \left(\frac{8}{3} d g \frac{\Delta T}{T}\right)^{1/2}$$

which shows that the large bubbles will rise faster than small ones and with a speed varying as the square root of the excess temperature. With ΔT about 1^0 C a 1000 ft. bubble will rise at 16 ft. per second. Glider pilot experience indicates that this is too fast (10 ft./sec. normal). It is probable then that the assumed drag coefficient of 0.5 is too high, the diameter too large or both.

Having looked at the rising velocity we must consider where this mass of hot air can come from. Radiation from the sun heated ground warms the layer of air near the ground and gives a layer several feet thick a lapse rate considerably greater than the dry adiabatic. If we assume that a 50 ft. thick layer has a mean temperature 2^0 C. above that of the air just above it, then the layer covering a field half a mile square would provide about 3×10^8 ft.^{3} of hot air. If this much hot air left the ground and diluted in the process with an equal amount of air from outside the super-adiabatic layer, thus reducing its temperature excess to 1^0 C. The volume is then

just tension. If ship twists in direction opposite of auto rudder turn don't release it. Try to tow it around into the direction of twist before release.

FLAT PLATE by John Wordin (SCAT)

Presented are the lift, drag, and pitching moment characteristics in coefficient form, for a flat plate. The data for constant angle of attack is plotted vs. Reynold's number in figure's 1, 2, and 3.

The test model configuration was a rectangular planform of aspect ratio 5. Airfoil outline and coordinates can be found in figure 4. As an example of how this type of data can be used, assume for a surface, a Reynold's number of 40,000. Holding R_e constant, a table can be made as follows:

Table I. Characteristics for constant Reynold's No.

α	C_L	C_D	C_M	
0	0.0	.014	-.001	@ R_e = 40,000
3	.19	.025	-.001	

Conventional polars of C_L vs. α, C_L vs. C_D and C_L vs. $C_{M.25}$ can be made.

The original data is taken from F. W. Schmitz "Aerodynamik des Flugmodells" Carl Lenge Verlag, Duisburg, Germany, 1960 4th edition, p. 84 and 85. It was replotted on 20 sq. to the inch paper and traced onto ditto master and can be retraced for accuracy.

POSTAL CONTEST - MONTREAL VS. SCAT

The results are in from Montreal by way of Doug Wilson. They started at PM Saturday June 29? Partly overcast 65 degree weather.

Wake:						
Gerry McGlashan	180	180	180	119	143	= 802
	180	180	180	157	180	
					circle under tow	
Don Greaney	180	150	175	121	150	= 756
	129	145	180	180	102	736
Point:						
	174	180	116	27	40	
	(D.T.)	(stalled)	(stalled)	tenible pattern		
Wake:						
Don Mackenzie	177	180	180	128	126	= 791
Nordic:						
Jim Grant	164	128	175		140	= 2319

Because of a dearth of power fliers the [illegible] flew as a makeshift team:

is always moving horizontally a little slower than the wind."

The concept of the thermal as a bubble rather than a vortex as has been assumed by others appears to provide a simpler, more reasonable model for the phenomena that we observe.

Undoubtedly the most important consideration we as model fliers worry about is how can you detect the presence of one of these things?

When you stand there with your gut hanging out, slack towline and determined/puzzled look on your face, what decision making process do you go through to either sweat it out some more or charge off down the field?

Here are some inputs that might affect the decision?

a) Somebody launched a Jasco Nordic and it looks like it may be in lift (maybe)

b) Dead calm.

C) Calm and then a breeze from prevailing direction at about normal speed.

d) Calm and then a gust from a different direction.

e) Calm and then a strong blast from prevailing direction.

f) Wind shift of 180°.

g) Dust devil lifts the club tent off the ground.

h) Your DT fuse burns through

i) Night falls

"a" Usually works but if there is wind don't count on this technique too much. Distortion of the rising column makes it hard to find.

"b" Forget it.

"c" Forget it.

"d" Go! (and dump it quick)

"e" Take it but don't expect miracles. This condition will stretch out your time a little by "dynamic soaring" but may not be a thermal. The gust will ride up on the dead patch of air you were in giving some lift but it usually doesn't last too long. Don't take this stuff if you are flying a calm air type airplane.

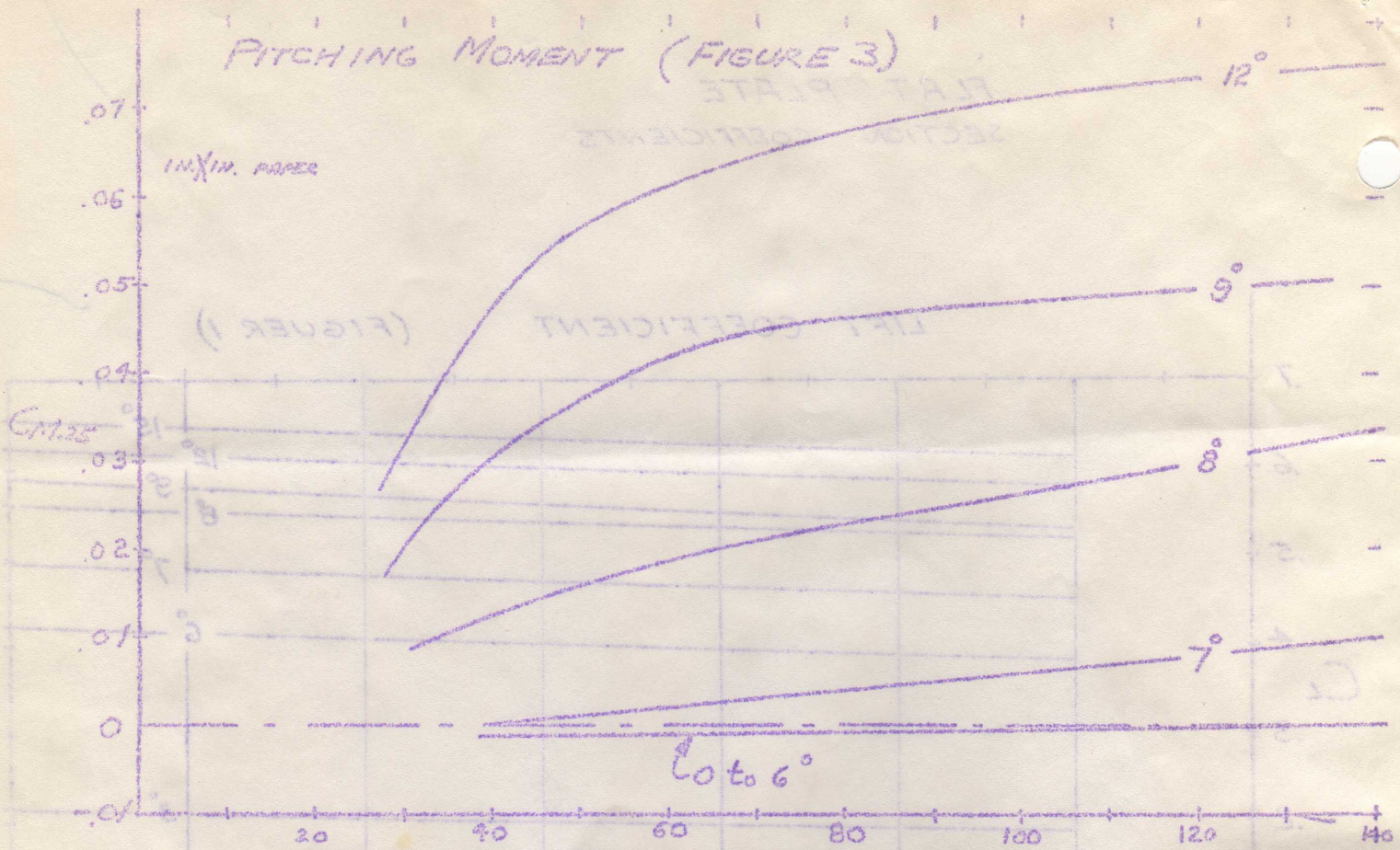
"f" Yipes! If you were back asswards to begin with, go!

"g" Take it if you've got the guts

"h" If you are not using a timer auto start, take up plastics.

"i" Oh well, there's always the year after next.

In the case of a steady prevailing breeze, tow it up and play it. Look for a twisting or wing rocking. This is usually more reliable than



X	0	1.25	2.5	5	7.5	10	15	20	30	40	50	60	70	80	90	95	100
Y_{UPR}	0	.8	1.0	1.3	1.4	1.45	1.45	—	—	—	—	—	→	1.40	.8	.4	0
Y_{LWR}	0	.8	1.0	1.3	1.4	1.45	1.45	—	—	—	—	—	→	1.40	.8	.4	0

L.E. RADIUS = 0.5

VALUES IN %C

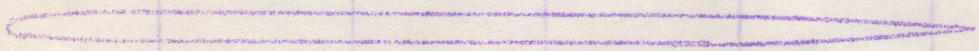


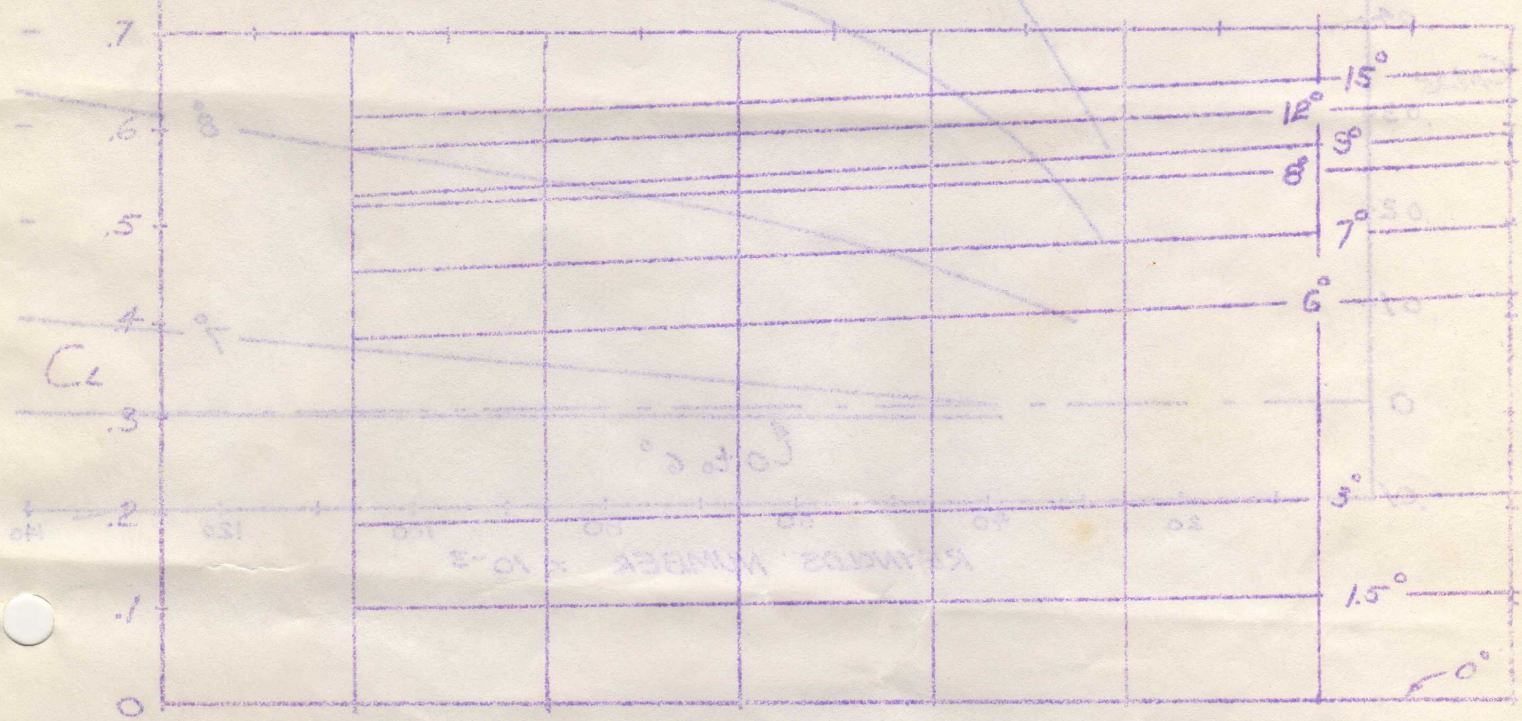


FIGURE 4 CONFIGURATION

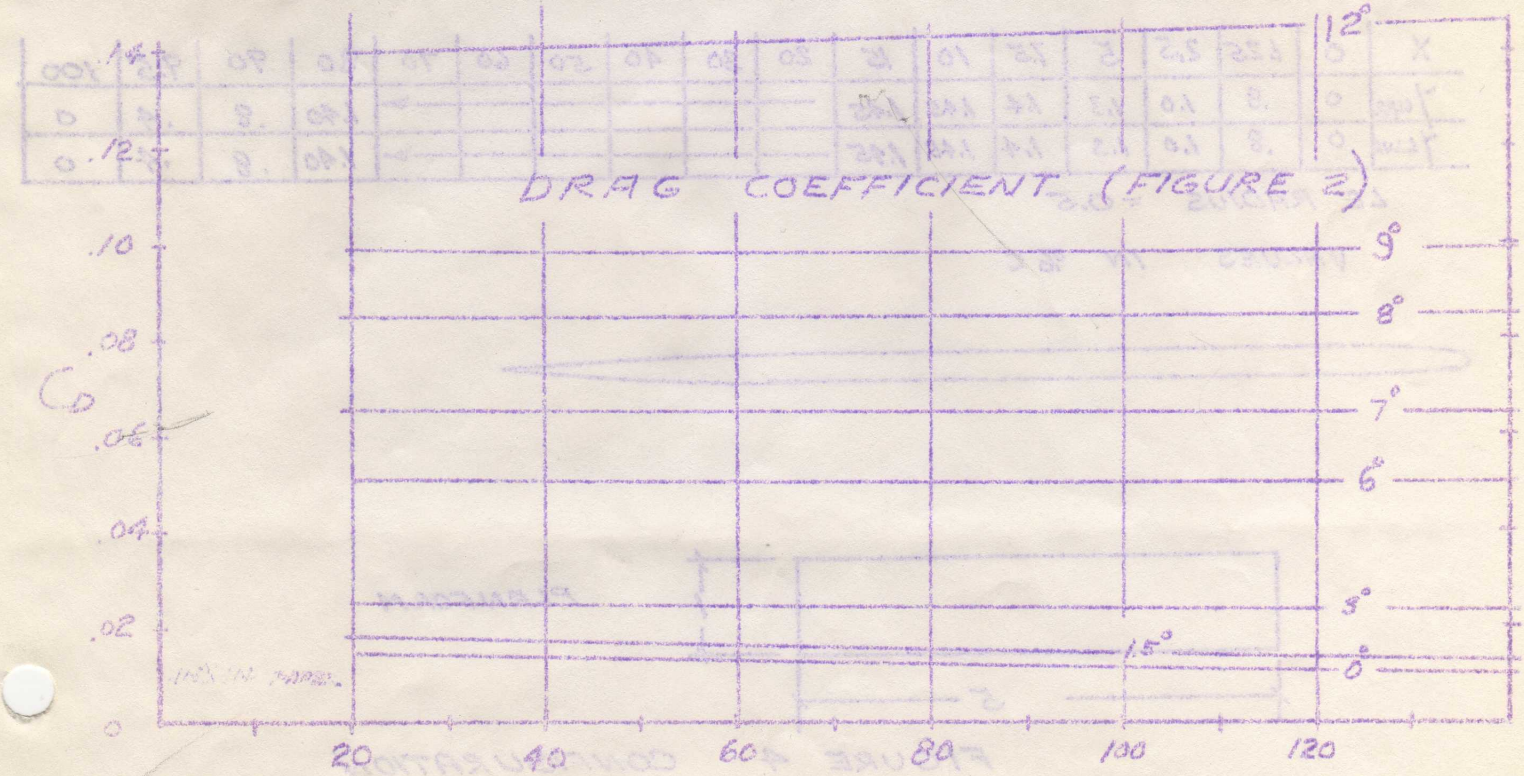
FLAT PLATE

FLAT PLATE
SECTION COEFFICIENTS

LIFT COEFFICIENT (FIGUER 1)



DRAG COEFFICIENT (FIGURE 2)



REYNOLDS NUMBER $\times 10^{-3}$

FAI Power

1. Vela (SCAT)	13:37
2. Mack (Steve)	13:02
3. Hartill (SCAT)	12:51
4. Dallimer (Steve)	12:39
5. Giggle (Steve)	10:48
6. Gildersleeve (SCAT)	10:06

SCAT	36:34
Stevenage	36:29
UHA	00:00

Total

1. SCAT	110:18
2. Stevenage	90:15
3. UHA	62.20

Too bad UHA couldn't scrape together some power fliers. However the following description of some of the flying by Wally Choy is just priceless!

"The Upper Hutt teams were composed of permutations of Malkin, Cook, Roots, and Choy. Conditions were good, although a stiff breeze came up later in the morning. Wakefields were the first order of the day, and Bill Cook, and Brian Roots were busily sniffing out the weak lift. John had his new Nautilus, Brian his Nats model, and Bill his old Faithful.

Conditions for Nordic A2 were not so good, with the drift in towards the hill. John begged out of this event and Welly Choy's old old old A2 was pressed into service. Last year, all three A2's cracked up on the line one after the other: this year both Brian Roots and Welly Choy had their models up on the hill. Brian's D.T.'d into a huge patch of Old Man gorse--so thick that he had to tunnel uphill through it to the model, and John Malkin couldn't see him at one stage when Brian was less than 6 ft. away in the stuff! He retrieved the model OK by strapping it all onto the fuselage and backing down a stream bed, dragging the model along after him. The most surprising thing was that although Brian had enough thorns in him to make God Save the Queen his favorite song, the model survived with nary a scratch. Meantime, back at the ranch, Welly succeeded in D.T.'ing onto the only clear patch in the bush near the top of the hill. Bill Cook and he fought up to the spot, only to find the"clear spot" was clear by virtue of the fact that it was a hunk of sheer rock face and the model was spread-eagled in the center of it.

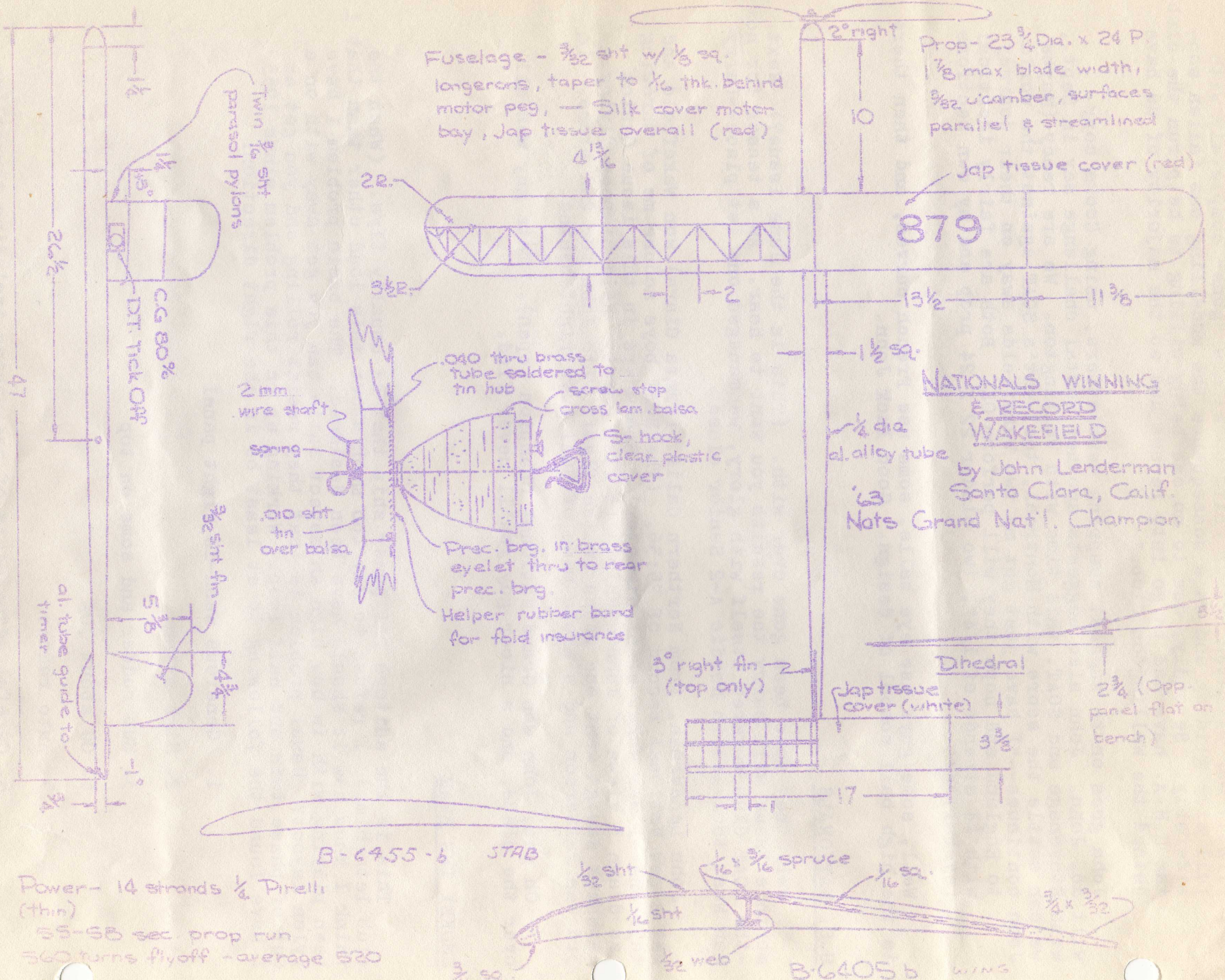
After getting those two models back, things weren't quite the same. Our sole FAI power entry, Choy's elderly Enya 15D (that old?) model finally trimmed out with an imposing vertical climb, and a tremendous recovery into a near vertical dive. Which wrapped that one up."

This description was lifted from the May issue of "Bull Sheet", the very well done Wellington Model Aeroplane Club (inc.) newsletter.

Editor: Wellington Choy, 28 Burden Ave., Wainuiomata, New Zealand. Send money and he will send issues.

Second bit of news from John Malkin reporting on what happened to Upper Hutt:

"By now you fellows will have been wondering what the heck is happening to us out here hence this note to keep you in the news.


Fuselage - 3/32 sht w/ 1/8 sq. longerons, taper to 1/16 thk. behind motor peg, — Silk cover motor bay, Jap tissue overall (red)
2° right
Prop - 23 3/4 Dia. x 24 P. 1 7/8 max blade width, 3/32 c'camber, surfaces parallel & streamlined
10
4 13/16
2R.
3 1/2R.
Jap tissue cover (red)
879
13 1/2
11 3/8
2
1 1/2 sq.
NATIONALS WINNING & RECORD WAKEFIELD
by John Lenderman
Santa Clara, Calif.
'63 Nats Grand Nat'l. Champion
1/4 dia. al. alloy tube
.040 thru brass tube soldered to tin hub
screw stop
cross lam. balsa
2 mm. wire shaft
Sr hook, clear plastic cover
spring
.010 sht tin over balsa
Prec. brg. in brass eyelet thru to rear prec. brg.
Helper rubber band for fold insurance
3° right fin (top only)
Dihedral
Jap tissue cover (white)
3 3/8
17
2 3/4 (Opp. panel flat on bench)
B-6455-b STAB
Power - 14 strands 1/4 Pirelli (thin)
55-58 sec. prop run
360 turns flyoff - average 520
1/32 sht
1/16 x 3/16 spruce
1/16 sq.
1/16 sht
3/4 x 3/32
3/16 sq.
1/32 web
B-6405 b WING

Firstly our bulliten editor (Bill Cook) has "gone" completely with full size gliding and as a consequence the modelling has fallen considerably. Secondly, due to no one being willing to help run the club the U.H.A. have had to go into recess and so the majority of us have joined the Wellington Club."

John goes on to suggest swapping newsletters, using Cooks copy. Will do, John. John also suggests another Postal challenge say in Sept., with Stevenage and SCAT, this time with Wellington. We are ready (Maybe we can settle the score with Montreal, too)--it's SCAT against the world. John continues---"I have just got my two Wakefields away on their journey to England and hope they will perform OK. Both are fairly identical, with 14 strands of 1/4", two blader 22 X 24 prop and my own sections (eyeballed)"

Well, some guys use eye balls, some use French curves, and then there is the high ball school of design. Good luck John.

U.S. NATIONALS

Well they done been gone over with. (This is the June issue?) Next month's issue will carry the results you want to hear. As a teaser for now--the SCAT club covered itself with glory, we managed one 1st place--Larry Van Nest took 1st in Nordic A-2 Senior class.

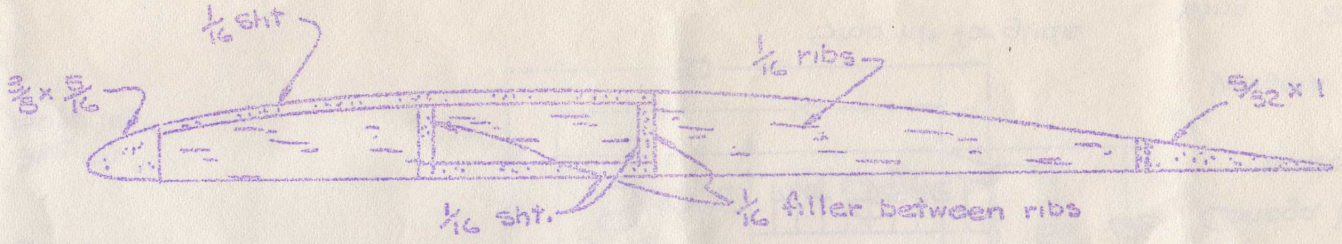
John Lenderman, from Northern Calif. (Santa Clara) won Wakefield and set a new National record of 25:36. (The SCAT boys accuse me of throwing this one--I was Wake. event director). Somewhere in this issue Cusick has drawn 3 views of John's ship. It flew great. Reid Simpson flying a Matsheck design went one round in the flyoff with John for 2nd place. In 3rd was Patterson and a whole mess of SCAT guys right behind.

Oh yes, John won Grand National Champion (open). This guy was all over the place, and a nicer guy you'll never find.

SMOKEY THE BEAR

This is the editors FAI power ship that he usually flys. (When the club lets him.) I refuse to say too much about this load other than that I think I know how it should have been designed. The basic problem I have been playing with is how high an aspect ratio can you get away with on a pylon layout? Usual problem is that they resist rolling and you get an out of phase twin and half loop. Working up on this problem since 1955 I have found the following to at least be in the right direction:

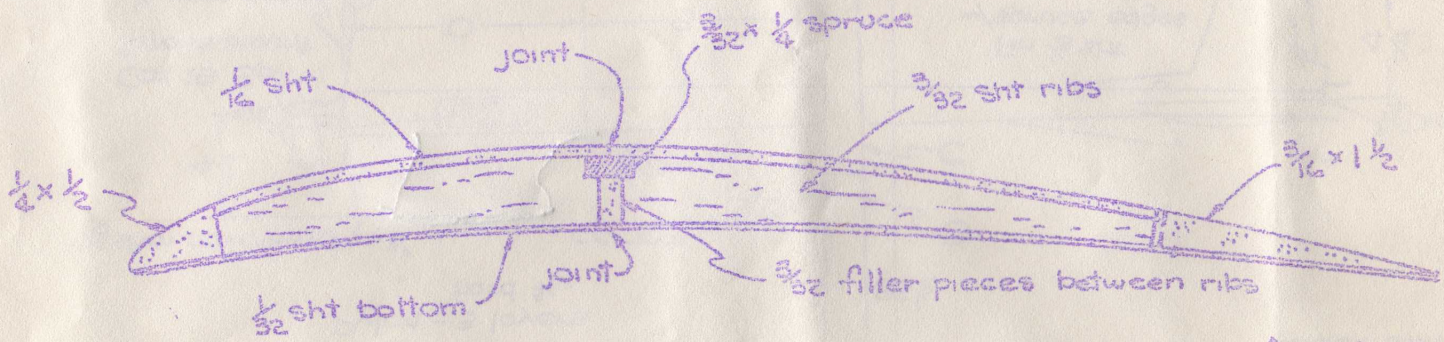
1. Generous wash-in right panel
2. High pylon
3. Sub rudder and some on top
4. CG about 70%
5. Auto rudder
6. Careful adjustments of everything including thrustline, incidence, wash-in, auto rudder. There is a "right"



Stabilizer Rib - pitch 1"

SMOKEY THE BEAR

sht. 2



Wing Rib - pitch 1¼"

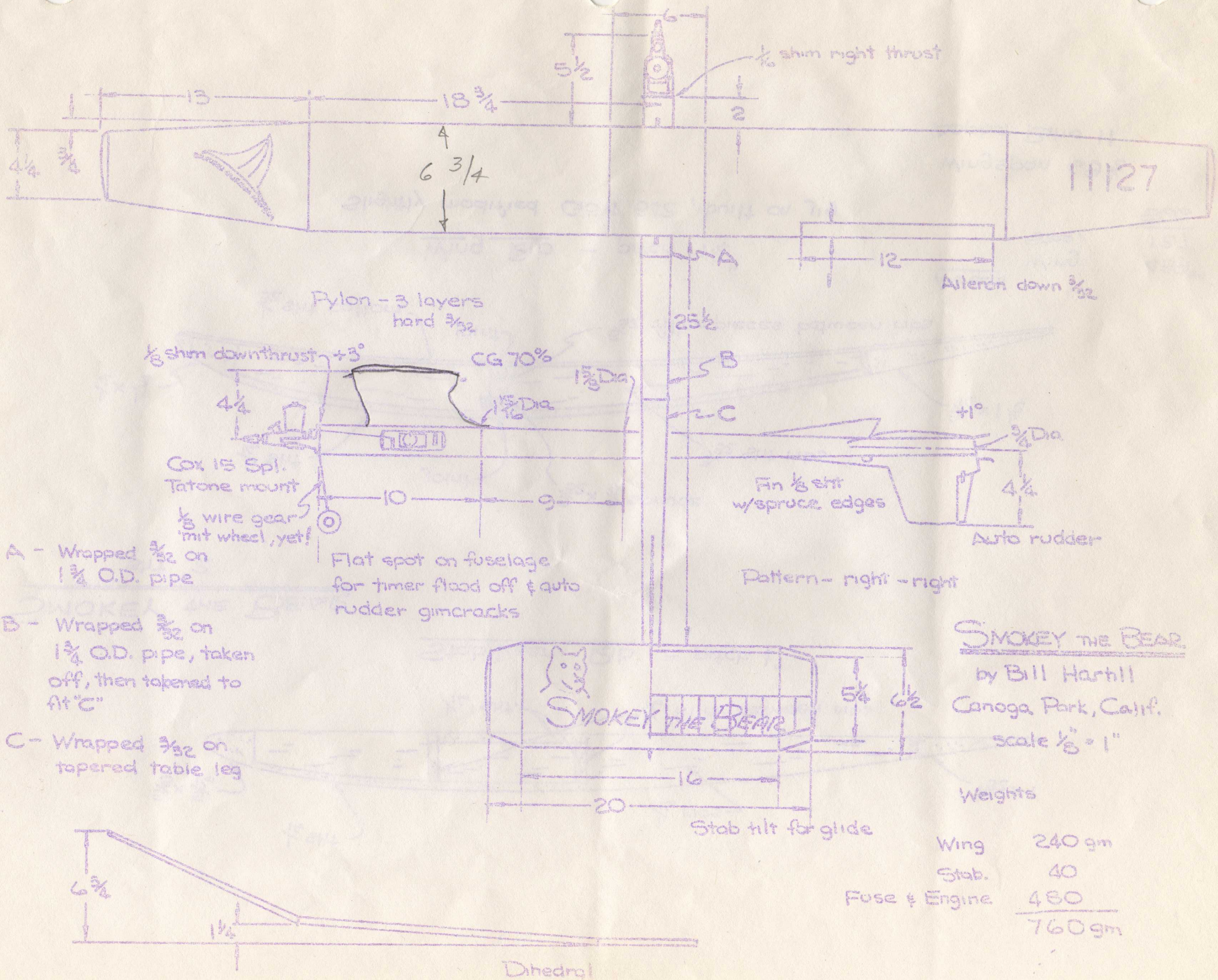
Slightly modified Gött 342, built on J19

Areas

Wing	439"
Stab.	127
	566

Wingspan 69½

Aspect Ratio 11


6
5½
1/16 shim right thrust
13
18¾
2
4¼
¾
6 3/4
11127
A
12
Aileron down 3/32
Pylon - 3 layers hard 3/32
25½
1/8 shim downthrust
+3°
CG 70%
1⅝ Dia
B
1⅝ Dia
4¼
C
+1°
¾ Dia
Cox 15 Spl. Tatone mount
1/8 wire gear 'mit wheel, yet!
10
9
Fin 1/8 ctr w/spruce edges
4¼
Auto rudder
A - Wrapped 3/32 on 1¾ O.D. pipe
Flat spot on fuselage for timer flood off & auto rudder gimcracks
Pattern - right - right
B - Wrapped 3/32 on 1¾ O.D. pipe, taken off, then tapered to fit "C"
SMOKEY THE BEAR
5¼
6½
C - Wrapped 3/32 on tapered table leg
16
20
Stab tilt for glide
SMOKEY THE BEAR
by Bill Hartill
Canoga Park, Calif.
scale 1/8" = 1"
Weights
Wing 240 gm
Stab. 40
Fuse & Engine 480
760 gm
6¾
1½
Dihedral

combination. Before you get it Smokey will do a lot of cork-screwing but still fairly safe. No sudden death like some I have flown.

The wing may look heavy to you but the strength is adequate with no flutter even at the bottom of a loop. (I said "fairly" safe.) The tip panels are butt jointed with no splices or gauze. Joint is prepared by sawing correct angles on table saw.

Fuselage front section "A" is made up of two layers of 3/32 rolled tube. Other two sections are progresively tapered to give curved effect. Joints are spliced inside. Slip in circular bulkheads about every 4 inches. Keep getting circumferential cracks in fuselage apparently because wood was too soft. Scarey! Another fuselage built this way for a B-C job hasn't cracked this way.

Oh yes, that crazy rudder shape came about when I decided the original had too much area on top. The new one helped.

The name Smokey the Bear came about at last year's semi-finals at Fresno. I got there and discovered that my stabs were still home. Called Sykora and got Harker and Ken to break into my garage to get them and bring up with them. Outside the phone booth was a big Smokey the Bear sign (Well if you had been there you would have gotten the picture.)

At the Nats this year I very cleverly short fused my second flight to get a 2:50. (Honest, Bob!) And so it goes.

——— N E X T M O N T H ———

Nats, natch and many good things headlining with Doug Wilson and his indestructible FAI and an Al Lewis reject-Hartill's Nordic!!!

FLY IN THE USA 1963 NATIONAL FAI CHAMPIONSHIPS

CHECK WITH YOUR LOCAL CONTEST DIRECTORS

RESULTS FROM FAI WORLD CHAMPIONSHIP MEET

-1963-

From Ron Moulton

thanks!

A/2 Nordic

1.	Erichsen, Hans Gerd (W. Germ.)	180	180	180	180	180	9
2.	Avory, Ernest (Canada)	180	180	180	180	171	891
3.	Modeer, Bo Hjalmar (Sweden)	180	180	168	180	180	888
4.	Nicolaas, Ed (Netherlands)	171	180	155	180	180	866
5.	McQueen, Peter (Canada)	180	177	145	180	180	862
6.	Rochin, Boris (USSR)	136	180	180	180	180	856
7.	Simonow, Wasilij (USSR)	142	180	180	180	168	850
8.	Lultchew, Luben (Bulgaria)	147	162	180	180	180	849
9.	Soave, Paolo (Italy)	126	180	180	180	180	846
10.	Riflawi, Afraham (ISrael)	173	120	180	180	178	831
31.	Hopper, Edward (USA)	80	144	180	180	160	744
34.	Ingersoll, Normann (USA)	180	19	180	180	180	734
56.	Frost, Arthur (USA)	147	59	180	115	113	614

Team Results (Nordic)

1.	USSR	2527
2.	Netherlands	2507
3.	W. Germany	2447
4.	Canada	2421
5.	Italy	2345
15.	USA	2097

Power

1.	Frigyes, Erno (Hungary)	180	180	180 210	180 240	180 270	900 +
2.	Laxmann, Lasse (Finnland)	180	180	180 210	180 240	180 233	900 +
3.	***Galbreath, Douglas (USA)	180	180	180 210	180 240	180 223	900+
4.	Dall Oglio, Alberto (Italy)	180	180	180 210	180 201	180 -	900 +
5.	Sereno, Antonia C. (Portugal)	180	180	178	180	180	898
6.	French, Georg R. (England)	180	180	180	180	166	886
7.	Keinrath, Hans (Austria)	164	180	180	180	180	884
8.	Braasch, Karl (E. Germ.)	162	180	180	180	180	882
9.	Green, Michael H. (England)	180	161	180	180	180	881
10.	Bulukin, Birger (Norway)	160	180	180	180	180	880
24.	Warnock, James (USA)	130	180	163	180	180	833
28.	Spearman, Frank (USA)	134	149	180	180	180	823

KEY TO PICTURE PAGE

The first five pix this month are the ones we had available at press time of the current FAI FF team members. Sorry we couldn't get you a full set....but some of the team members must be bashful 'bout having their picture took!

1. This is Doug Galbreath, Western Power Team Member, and his well known "High Society" ship which was published in SCATTER.

2. This will be a familiar face to many FAI teams from other lands...it's Carl Harnes of the '63 Wakefield Team...Carl's been on several other teams and always puts up a good show in the Finals. (Ship appeared in May '63 SCATTER.)

3. Here's Norm Ingersoll of Utah who holds down the A/2 spot and rounds out the Western part of the '63 Finals team. (Ship was in Oct. '62 SCATTER.)

4. Meet Ed Hopper of Baltimore, Md., who is the Eastern Team Member in Nordic A/2.

5. We ask you, is that style, or is dat style???? Meet Sal Cannizzo, of Long Island, N.Y. Sal who is the Eastern team member for Wakefield is shown launching for his winning fly-off flight at the Semi's.

6. Dick Gildersleeve of SCAT pushes hard on "Gumbird", a Wake based on Hartill's "Thunderbird". (April '64 SCATTER)

7. From windy ole England we see Bernie Mack during a recent Stevenage/SCAT postal bash. Ship is a Lucky Lindy with ETA 15 up. Nice piece of work!

8. Wakefield craftsman Bill Poesch of Los Angeles, peels off his shirt and shows us his beautiful "Sunburst" (plans in Aug. '64 SCATTER). Wing, center panel, and fuse. motor tube are aluminum/balsa sandwich.

9. Ed Schnakenburg of Manhattan Beach, Calif., shows how to get his "bent banana" type Power ship away. Hutchinson and Trego of SCAT try to pick up a few pointers.

10. Trevor Faulkner of the Stevenage bunch buttons-up a real smooth looking all sheet Wake. Gentleman in the shrubbery was unidentified!

11. John Wordin, hard working SCATTER corresponding secretary, steps out on the field to prove he doesn't spend all his time answering the endless mail traffic!

12. SCAT-man Bill Kreeck talks to his Wakefield while pointing the way to a max! Taken during the last Stevenage/SCAT postal contest. The belt outside Bill's shirt hooks onto the winder, and takes all the work out of putting in the turns.

Team Results (Power)

1.	Italy	2598
2.	Hungary	2598
3.	England	2579
4.	**USA	2556
5.	CSSR	2544

Wakefield

1.	Loffler, Joachim (E. Germ)	180	180	180 210	180 240	180 243	900 +
2.	Hakanson, Anders (Sweden)	180	180	180 210	180 240	180 186	900 +
3.	Murari, Bruno (Italy)	180	180	180 210	180 132	180 -	900 +
4.	Wagner, Horst (Austria)	180	180	180 185	180 -	180 -	900 +
5.	Sundin, Rolf (Sweden)	180	162	180	180	180	882
6.	Melenitiev, Evgueniji (USSR)	180	180	161	180	180	881
7.	Petiot, Alcideroger, (France)	156	180	180	180	180	876
8.	Mc.Gillivray, Jack (Canada)	180	180	177	180	159	876
9.	Galgoczi, Sandor (Hungary)	180	180	180	150	180	870
10.	Mabille, Alfred (Belgium)	149	180	180	180	180	869
29.	Knoeland, Dave (USA)	180	180	180	89	180	809
43.	Hermes, Carl (USA)	180	91	180	105	180	736
56.	Cannizo, Sal (USA)	30	180	138	149	138	635

Team Results (Wakefield)

1.	Italy	2576
2.	Yugoslavia	2513
3.	Sweden	2480
4.	Hungary	2479
5.	Canada	2445
14.	USA	2180

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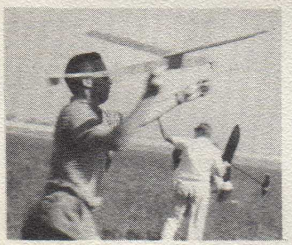
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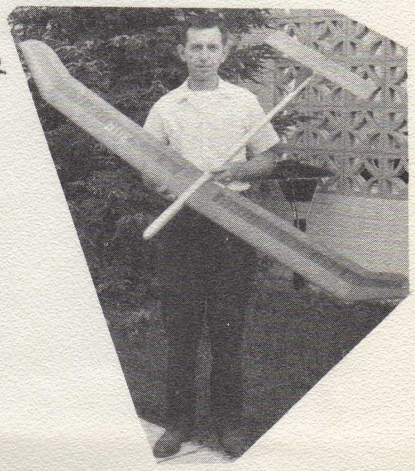
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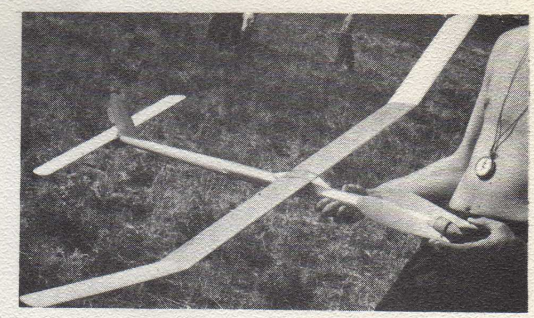
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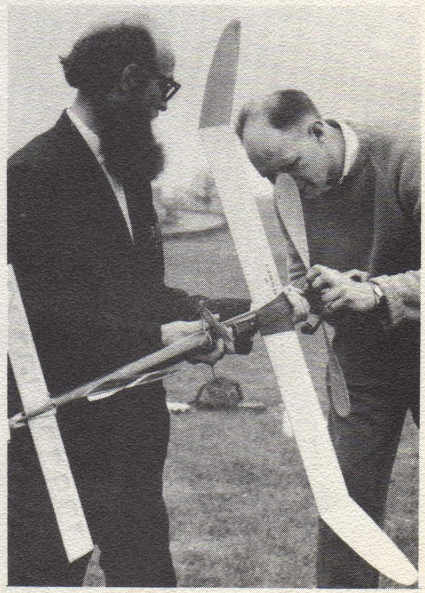
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