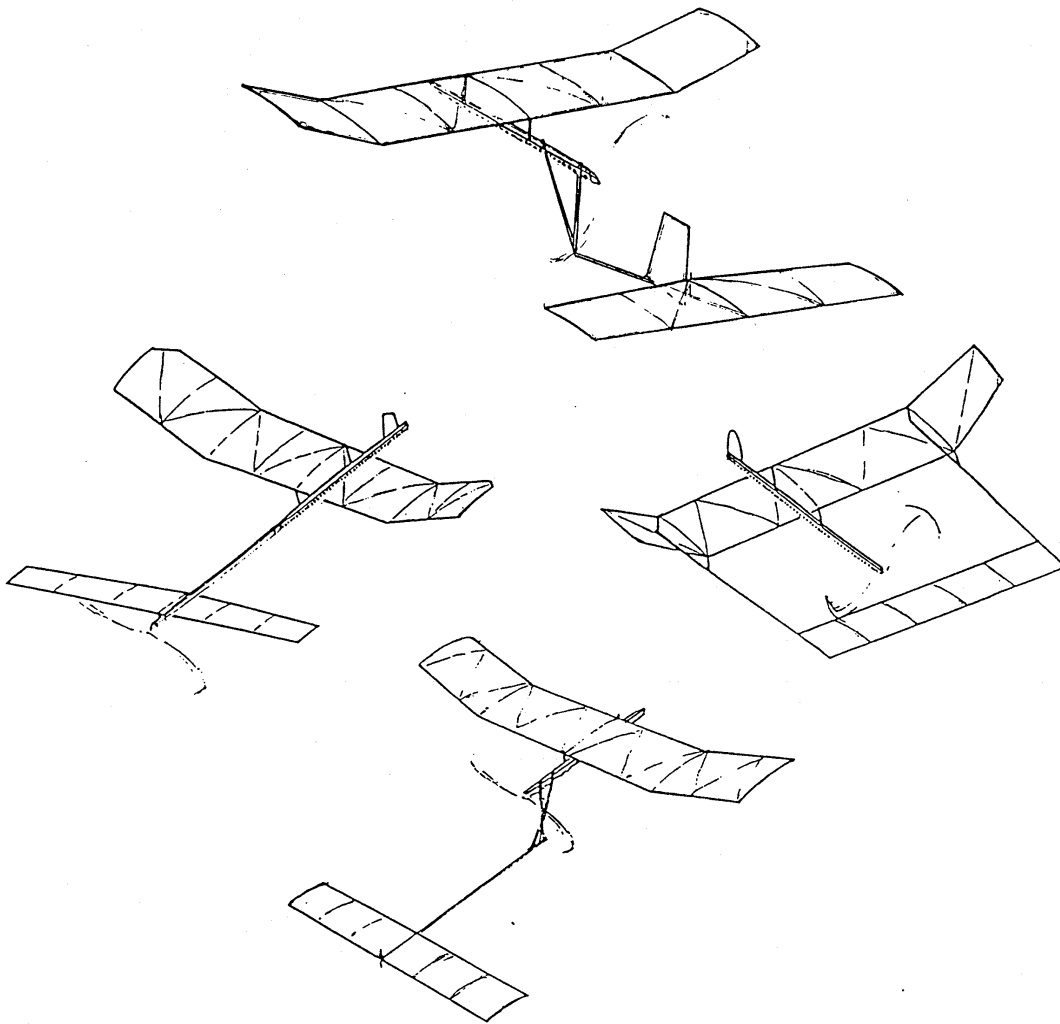


Putting  
"PUSHER PROGRESS"  
in  
Perspective



Author and Draughtsman 'par excellence' John Barker  
Additional Drawing by 'gifted amateur' John Dixon  
Archive material and 'photocopy flair' Dave Yates

Because I stuck my neck out in October by suggesting how the Pushers might perform Dave Yates thought I should round off the season with a some more words and perhaps eat a few if necessary!

The pushers look quite delightful in the air and have made a refreshing change from the usual indoor configuration. They have also proved to be very easy to fly - presumably because of the small propeller which is required by the rules. However although easy to fly they are not easy to fly to high times in competition. This is because of their uncoöperative (downright perverse!) behaviour on touching the roof. In the absence of a propeller at the front to help it round in the turn the model will skate off, usually in a straight line, for the nearest wall. Various 'whiskers' have been seen protruding from the upper sides but none seem to work as intended and the best times have been put up with the best steering.

I have drawn plans of three models, by John Taylor, Dave Yates and myself. These were chosen because they were representative of the types commonly flown and because I had easy access to information on them! Additionally John Dixon (at Dave's request) has drawn the plans of his machine which performed so well at the end of the season

GRISELDA by John Taylor This looked like an obvious layout for a pusher at first glance but at the second look you realize that it is not so easy structurally and, as a consequence, I think that this is the only one competing. John has solved the boom fixing by using pegs and tubes as on a wing mount. The motor stick is very long to take long motors easily; it also places the propeller very close to the tailplane which is seen as an advantage for stability.

The model has a large wing and is probably the slowest flying of all those around. It has put up some high times but in competition it has tried to be a fly on the wall and John is rapidly learning the technique of steering.

Did you wonder about the name? Well, pushers seem to make everyone think of the pioneering days of flight and it put John in mind of the great Claud Graham White. Looking for a feminine equivalent of Graham the nearest he could find was Griselda. Well, that's what he told me but I can't help wondering ....!



RETROACTIVE by Dave Yates This is the layout that I, and I suspect most other flyers, never thought of when the rules were announced - a normal aeroplane but with the propeller at the back. Yet it has performed very well for Dave and Bill Murray who each hit on the idea independently.

Of course it is not as simple as that. Although it looks like a normal layout there is a significant difference in the long, divided propeller shaft which gets the weight of the rubber well forward. Also note the important feature of the soldered washer which keeps the rubber loads on the stick and allows a light boom.

Bill took the first place in the first contest. He started with a lash up of heavy bits to come up to the 1.8g but this gave a short moment arm and a not very settled flight. A new model was constructed with an enormous 4.25 chord but very light which allowed ballast to be added to the nose giving a longer moment arm and a much better flight pattern.

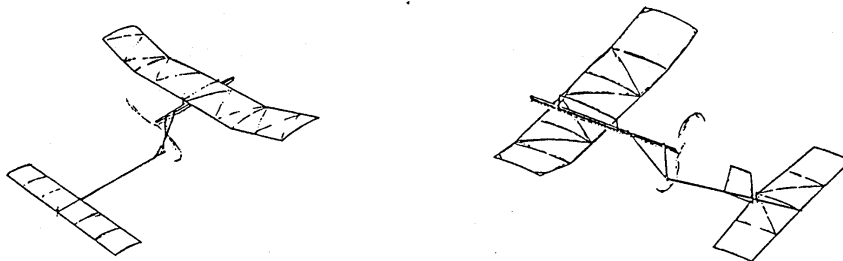
Dave has taken a third and a second place in the two contest which speaks well for the layout. Incidentally Dave says that pusher props make the models easy to steer. (Some people are so cocky - steering is never easy!)

By the way, Dave was very lucky to get his design published - it is usually necessary to be called John.

HENRIETTA by John Barker I christened this the 'Farman' layout in my original article and the name seems to have stuck. I apologize to all the scale aficionados because Farman produced many other aeroplanes of all types but to those of us of a certain age a Farman is an FE (Farman Experimental-pusher) as distinct from a BE (Bleriot Experimental-tractor)! I suppose it could have been called Maurice or Henry after the brothers but as aeroplanes are feminine I decided on Henrietta.

I started with old EZB flying surfaces to try things out but later made a 3.5 chord wing and corresponding larger tailplane. Trying the large wing with the EZB tailplane showed that the big tail was not necessary. See later remarks on prop effects. The machine has been flown with the boom above the propeller (by turning the stick over) and below with little difference in performance. I have settled on the low position to let the prop hit the ceiling (but it doesn't!) and because I think it better to have the prop wash on top of the tailplane.

I think that its potential performance is similar to the others around but its competition performance is something else. With a steering pole in my hands I am a menace and Henrietta usually dives for safety down the nearest wall before I can get a touch on her derriere.



THE CURATE'S EGG by John Dixon With a layout similar to 'Henrietta' John Dixon took fourth place in December and a devastating first in March with times a minute ahead of even the second place. After looking at the model I can't see any secrets so I think that John must have been cheating by such means as diligent preparation, delicate steering and brilliant flying.

Seriously, John's model merits attention if only for its size. The total surface area of the four models here are: Henrietta 87, Retroactive 92, Griselda 104 and the Curate's Egg 109 in<sup>2</sup>. John has also sacrificed a tenth of a gram to put the length up to 19".

The large fin with its big offset interests me. Is the offset to compensate for the swirl of the slipstream close behind the bottom prop blade? Would it fly as well without the fin as has been the case with the other three models?

PROPELLER EFFECTS One thing that the pusher has demonstrated is that the propeller also acts as a flying 'surface'. If you look at the plans you will see that only one of them has a rear fin. In the case of 'Retroactive' and 'Henrietta' this is partly due to the propeller being aft of the CG and partly due to the tailplane tilt. In the case of John Taylor's machine it is all due to the propeller because there is no tail tilt used. The NACA investigated the effect of propellers on stability in TR 820 (1945). They suggested for approximate estimates that the propeller should be treated as a surface with a span equal to the diameter and an aspect ratio of 8. Note that this notional surface acts in the horizontal and the vertical plane; i.e. as a tailplane or foreplane and as a fin. We don't think about this effect on tractor machines because we have grown up with it and make our tailplanes and fins bigger to suit from past experience. To me it is fascinating to see aerodynamics at work in this way.

LAST WORDS Perhaps I need not eat too many. My concern about balance seemed to be well founded and builders are making light airframes so that ballast can be used.

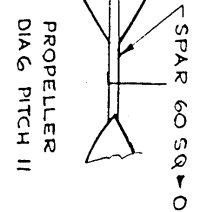
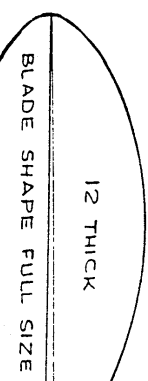
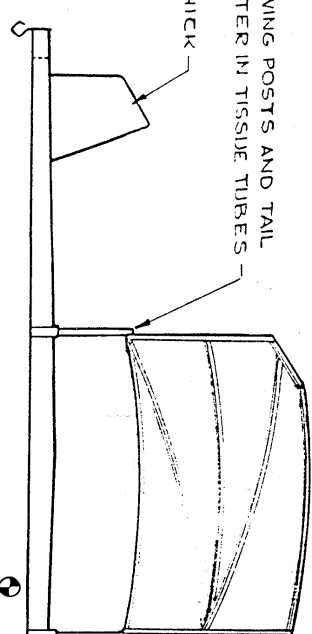
I predicted a time of 6:34 for a pusher with 4" chord and John Dixon did a 6:23 and two 6:31s in the last event! Satisfying? Yes, but a lot of good luck - the calculations were never intended to be that accurate. Indeed, watching the models fly this season, the propeller/power combination looks 'easier' than I would have expected with no undue thrashing round at the start therefore I think that my guesses of energy usage and prop efficiency can be bettered. If we say another 5% then you should be able to do 7:30 next season - I won't, I shall still be learning to steer.

I apologize to those flyers with interesting models who have not been mentioned, time and space just did not allow it. But why not write something yourself; I find nothing is more interesting than when someone explains why they did things a certain way.



φ 60 WING POSTS AND TAIL ADJUSTER IN TISSUE TUBES

12 THICK



POWER 15 .146g  
OF .97g/lm IN A  
75 cm LOOP,  
3050 TURNS  
250 BACK OFF.

DIHEDRAL 1.85  
WASH IN .05 ON PORT TIP

SOLDERED WASHER  
φ 1/8 SHAFTS IN HARLAN BEARINGS

WING SECTION 5% ARC. STRAIGHTS 8.8 R. DIAGS 13.5 R.  
TAIL SECTION 4% ARC. 6.9 R.

**WEIGHTS**

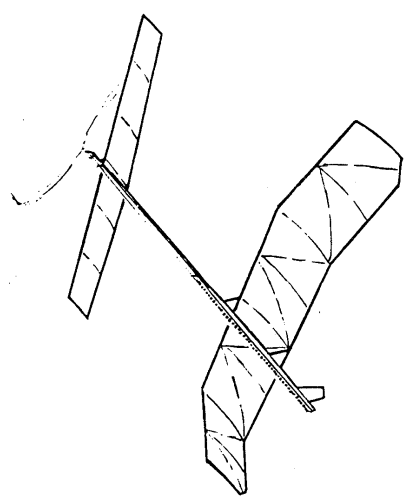
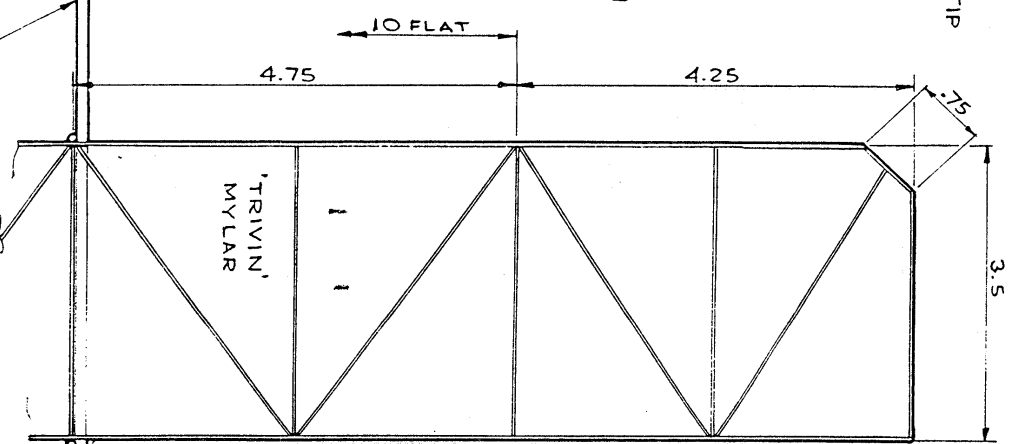
STICK + BOOM	.760
TAILPLANE	.120
WING	.410
PROPELLER	.155
DRIVE SHAFT	.280
BALLAST	.235
	<u>1.960</u>
	9

TIP SPARS  
30 THICK 50 DEEP  
CENTRE SPARS  
30 THICK 75 → 50 DEEP  
RIBS  
25 THICK 45 DEEP

BALLAST

STICK 135 THICK  
200 → 250 → 200 DEEP

DIMENSIONS IN INCHES - MATERIALS IN THOUS.



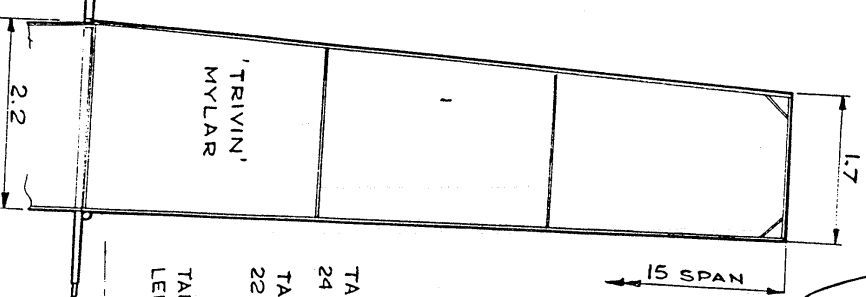
**RETROACTIVE  
PUSHER FOR 1992/3 SEASON  
DAVE YATES - NORWIND**

BOOM 125 → 80 THICK  
200 → 150 DEEP

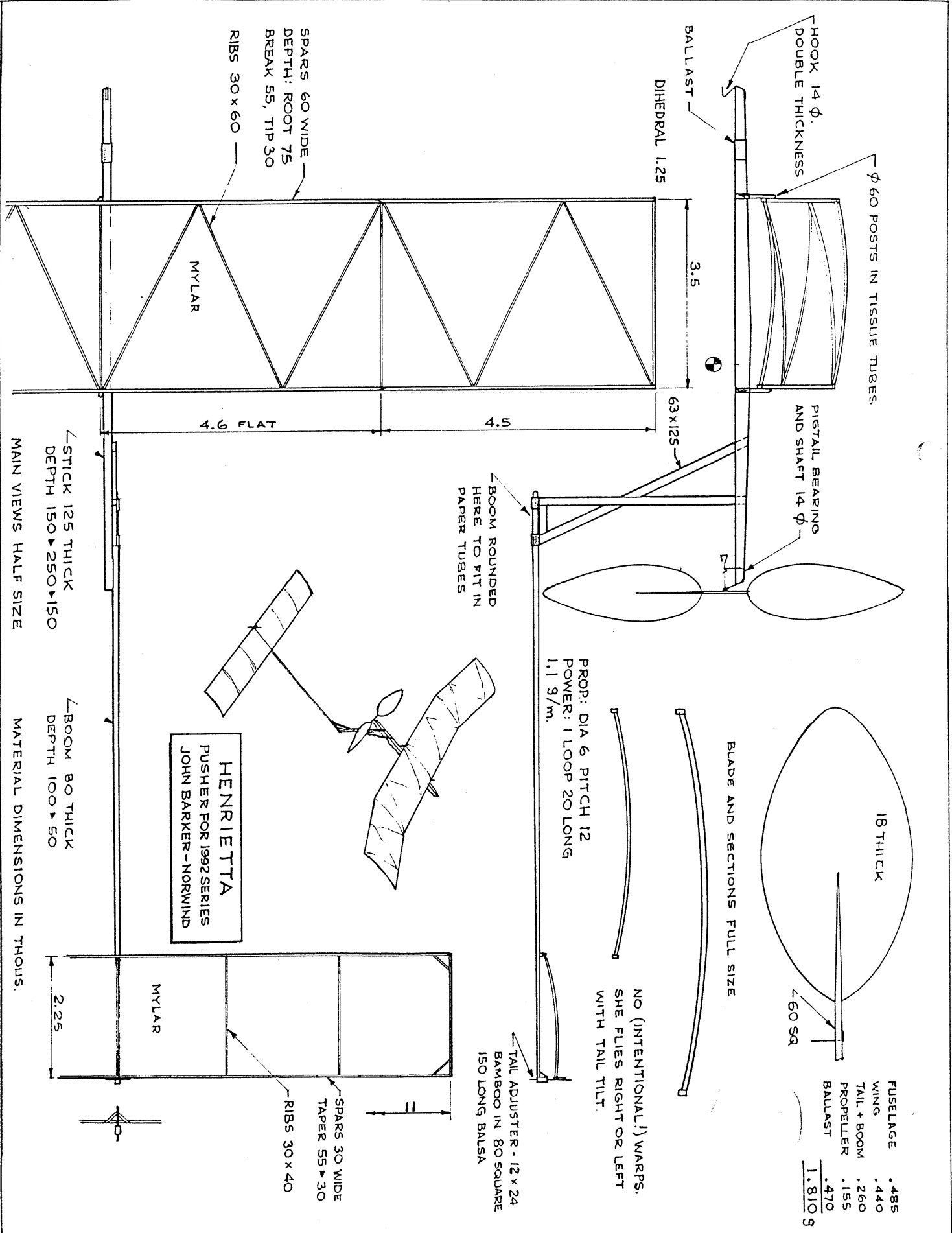
'TRIVIN'  
MYLAR

TAIL SPARS  
24 THICK 50 → 30 DEEP  
TAIL RIBS  
22 THICK 30 DEEP  
TAIL TILTED WITH  
LEFT TIP UP 0.5

15 SPAN



MAIN VIEWS HALF SIZE

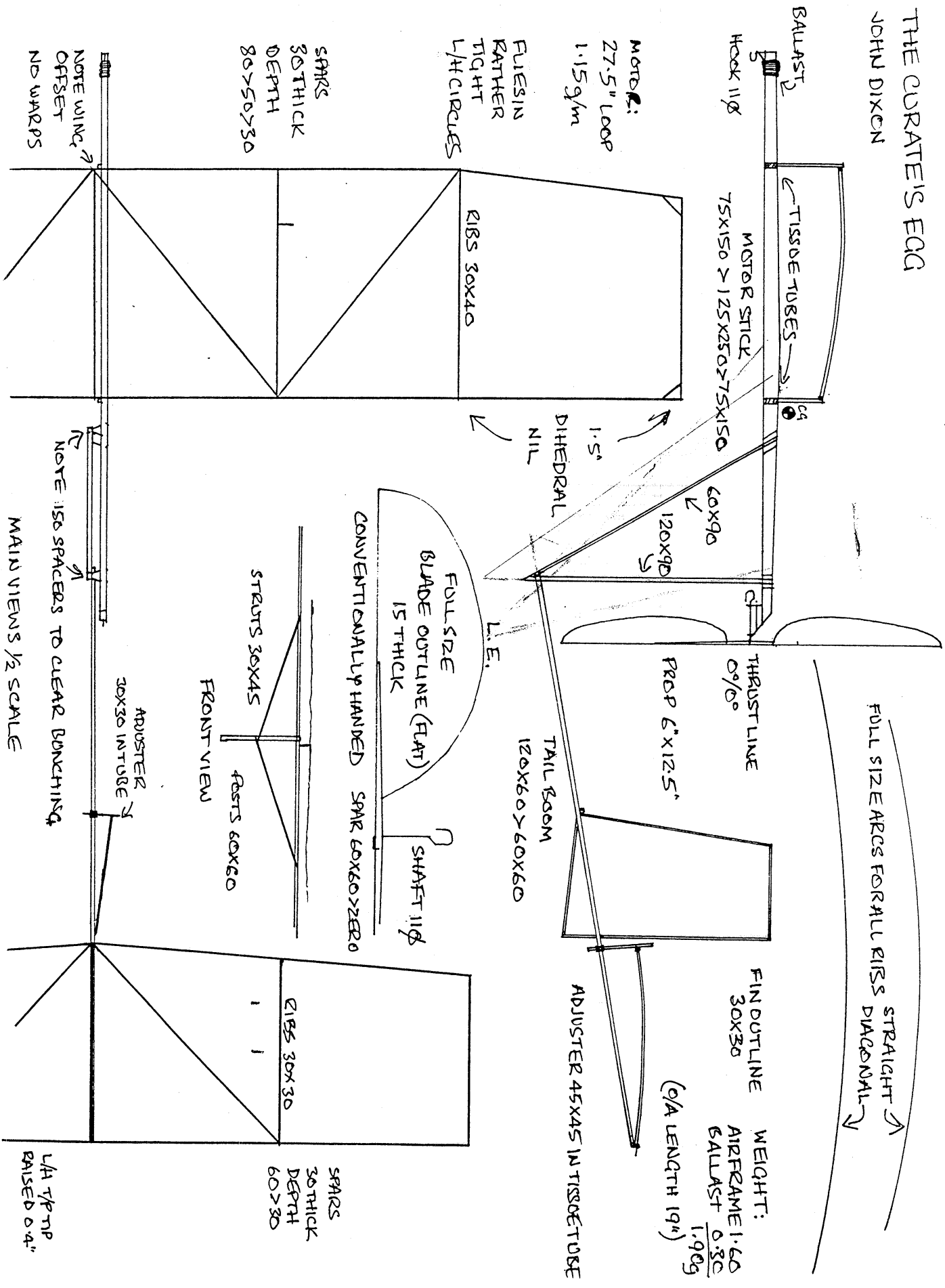


FUSELAGE	.485
WING	.440
TAIL + BOOM	.260
PROPELLER	.155
BALLAST	.470
<b>TOTAL</b>	<b>1.810</b>

**HENRIETTA**  
 PUSHER FOR 1992 SERIES  
 JOHN BARKER - NORWIND

# THE CURATE'S EGG

JOHN DIXON



FULL SIZE ARCS FOR ALL RIBS STRAIGHT DIAGONAL

WEIGHT:  
 AIRFRAME 1.60  
 BALLAST 0.30  
 1.90g  
 (O/A LENGTH 19")

FIN OUTLINE 30X30  
 ADJUSTER 45X45 IN TISSUE TUBE

TAIL BOOM 120X60 TO 60X60

THRUST LINE 0°/0°  
 PROP 6" X 12.5"

MOTOR:  
 27.5" LOOP  
 1.15g/m  
 FLIES IN RATHER TIGHT L/H CIRCLES

SPARS 30 THICK  
 DEPTH 80 TO 50 TO 30

NOTE WING OFFSET NO WARPS

CONVENTIONAL HANDED SPAR 60X60 TO ZERO  
 FULL SIZE BLADE OUTLINE (FLAT) 15 THICK  
 L.E.  
 SHAFT 11 gauge

FRONT VIEW  
 STRUTS 30X45  
 FASTS 60X60  
 ADJUSTER 30X30 IN TUBE

NOTE 150 SPACERS TO CLEAR BUNCHING  
 MAIN VIEWS 1/2 SCALE

SPARS 30 THICK  
 DEPTH 60 TO 30

L/H TIP RAISED 0.4"

Best single flight from any number

<u>First event December '92</u>				<u>Second event March '93</u>			
Bill Murray	3:15	4:29	4:29 (1)	John Dixon	6:06	6:31	6:23 6:31 (1)
Adrian Abell	4:06	4:01	4:06 (2)	Dave Yates	5:17	5:05	5:32 5:32 (2)
Dave Yates	4:04	3:59	4:04 (3)	Bill Smith	3:27	5:16	5:25 5:25 (3)
John Dixon	3:51	3:55	= 3:55	Adrian Abell	4:13	5:04	5:17 5:17
John Barker	3:55		= 3:55	John Taylor	3:49	5:00	5:00
John Taylor	2:36	3:53	3:53	John O'Donnell	3:35	4:46	4:46
Peter Boddie	3:19	3:30	3:30	Squire Kay	3:32	4:02	4:41 4:41
Squire Kay	3:04	3:15	3:15	Bill Murray	4:16		4:16
Derek Hardman	3:02		3:02	Roy Roberts	3:33	3:28	3:33
John O'Donnell	3:00		3:00	John Barker	2:33	3:08	3:08
Roy Roberts	2:42	2:56	2:56	Reg Boor			- (11)
Reg Boor	2:06	2:36	2:36				
Don King	2:19	2:18	2:19				
Bill Smith	-	-	- (14)				

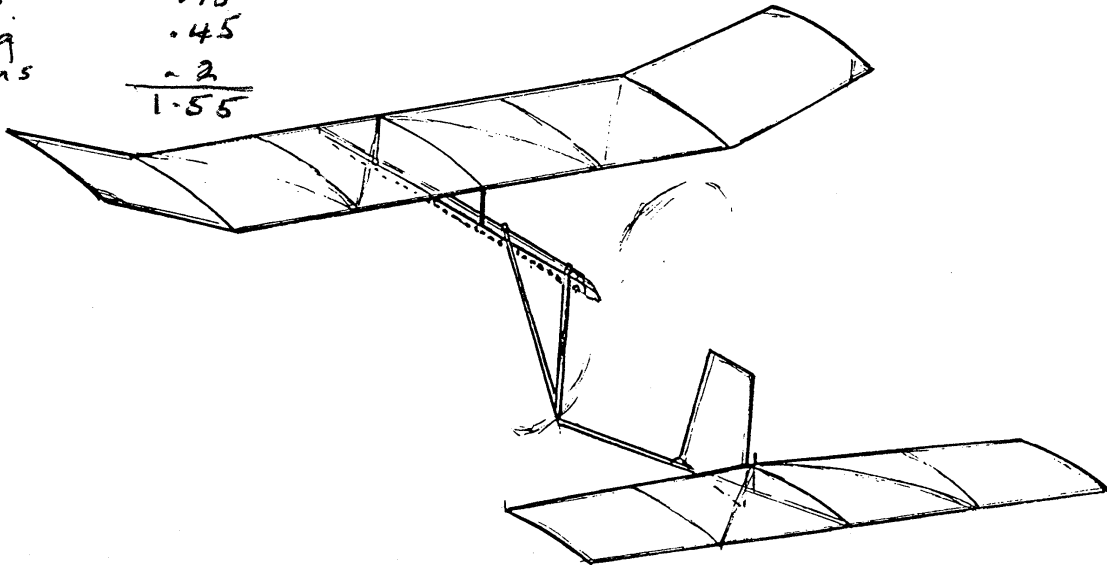
'Pusher' definition: Motor in front of Propeller

Maximum Wing Span (projected). 18 inches  
 Maximum Propeller dia. one third of Wing Span  
 Overall Length. Unrestricted  
 Covering material. Unrestricted  
 Minimum Weight. (.10gm. per inch of Wing Span)  
 (or Overall Length if greater)

Stick 0.6  
 T.P. .15  
 Prop. .15  
 Wing .45  
 Booms .2  


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 1.55



NORWIND NEWS

This Supplement published by the North West Indoor Association is being sent to all NORWIND members as part of their annual subscription of five pounds.  
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