NOTES ON PLANKS

For the past two decades the most popular tailless RC sailplanes have been planks, and there are many full size plans available.

A common plank design consists of a constant chord wing with no sweep, a centrally mounted elevator, and a large rudder. Planks of this type have a very simple structure that lends itself to rapid building. Stability in pitch is achieved by reflexing the last 20 to 25% of the airfoil and having a forward CG.

The reflexed sections used by planks are essentially one speed airfoils. When flying too slow the forward CG pitches the model down and speed increases; when flown too fast the reflex pitches the model up and speed decreases. Planks are thus very stable and make great trainers - both of us learned to fly proportional with a plank, Dave Jones' "Raven MB."

Plank type 'wings fly about 50% faster than conventional airplanes of the same wing loading, but with their inherently draggy reflexed airfoil their glide ratio is not good, and dead air duration is about one half that of a conventional sailplane. Yet a good plank, in capable hands, will outclimb a conventional sailplane in a thermal! Planks have a low wing loading, can turn tightly, and some, like the Raven, will automatically center themselves in a thermal, hands off!

The stable reflexed section brings with it two unique problems:

(1) It's quite disconcerting to try to dethermalize a plank by diving. The wing has a positive camber with the elevator down and so its lift increases. As the 'wing gains speed the increased lift can actually offset the down elevator being applied. We've often found ourselves in nearly level relatively high speed flight with moderate down elevator! Ken Bates recommends diving inverted when dethermalizing his "Windlord." (Plans available through Model Aviation.)

(2) Thermaling with full up trim sets the turn and lowers flight speed. But this increases the effective reflex and applies a big down load to the wing - just the opposite of what you want in a thermal turn when attempting to make the best use of available lift.

Some flyers of both full size and model size planks, rather than relying on elevator trim which is always drag producing, have experimented with a sliding weight device that adjusts trim for high speed and thermaling flight modes. The trim on our Ravens is noticeably changed with the addition or removal of a 1/4" cube of lead, and so it doesn't take much weight shifting to change trim significantly. The system works well but entails an added mechanism.

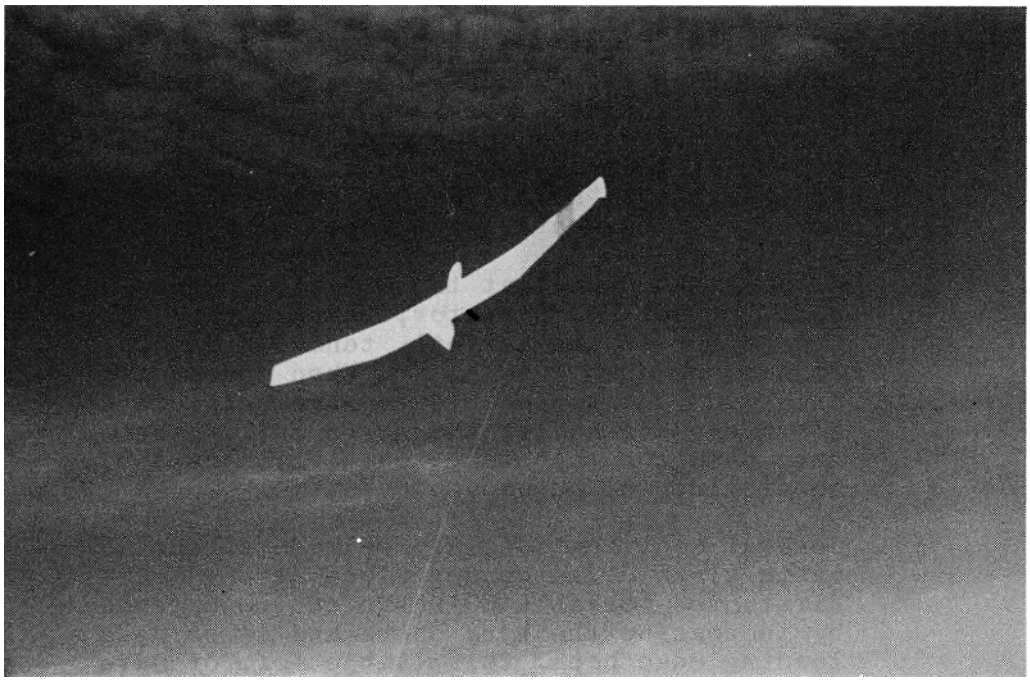
Always make sure that the elevator servos pull for up. The elevator, being a part of the reflex of the airfoil, tends to have a consistent down load on it. When speeds are high you want to be able to have reliable up elevator, and having the servo pull rather than push for that function eliminates the possibility of pushrod buckle.

Several modifications can be made to the basic plank deign we described at the start. First, the workable CG range can be extended by increasing the wing chord and sweeping the leading edge back. This is the form of Dave Jones' "Blackbird 2M," spoken of so often in this column. A second modification of the basic plank involves sweeping the trailing edge forward while maintaining a straight leading edge. The resulting planform is good for maintaining effective aileron control and nearly eliminates any pitch changes brought about by aileron differential. Jim Marske's full size Pioneer II is an excellent example of this planform.

Contrary to popular opinion, flaps can be used on planks. While tows are straight and steep without them, the climb rate is improved. Also, they are effective landing aids. Their area should be no more than 5% of the wing. Install them on the bottom wing surface at 40% local chord; they won't affect pitch much when located there. Deflections

of 40^{o} are effective. Flaps should <u>not</u> be used when thermaling!

A final comment: You must adhere to the FAI minimum wing loading of 3.96 oz./ft^2 when competing in AMA events, and its very easy to build planks well below that minimum.



AR 193-S75

X	Y
100.0	0.0
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98.674	0.0
97.108	0.018
95.023	0.113
92.452	0.227
89.414	0.398
85.945	0.625
82.096	1.023
77.923	1.675
73.484	2.462
68.839	3.286
64.052	4.265
59.186	5.052
54.306	5.824
49.458	6.485
44.673	7.005
39.979	7.363
35.402	7.55
30.967	7.566
26.696	7.418
22.62	7.131
18.78	6.724
15.218	6.215
11.967	5.6
9.061	4.91
6.525	4.157
4.383	3.356
2.652	2.528
1.344	1.699
0.465	0.901
0.026	0.189
0.0	0.0
0.129	-0.379
0.819	-0.862
2.044	-1.312
3.791	-1.699
6.049	-2.019
8.801	-2.27
12.026	-2.453
15.697	-2.576
19.778	-2.646
24.227	-2.672
28.998	-2.665
34.035	-2.636
39.28	-2.593
44.672	-2.547
50.145	-2.504
55.63	-2.472
61.059	-2.454
66.364	-2.452
71.479	-2.468
76.339	-2.431
80.882	-2.315
85.05	-2.171
88.788	-1.884
92.048	-1.553
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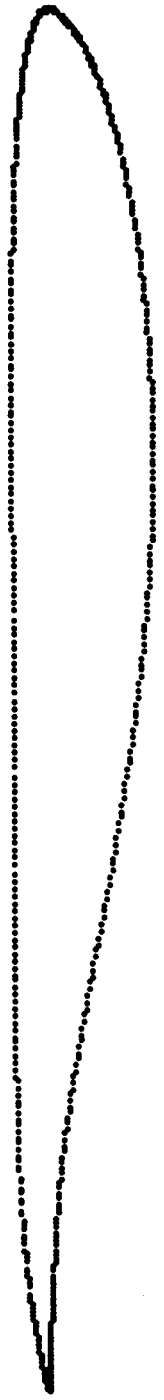
98.64	-0.455
99.655	-0.227
100.0	0.0



CJ-25^2-09

X	Y
100.0	0.0
96.092	0.227
92.144	0.372
88.191	0.513
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82.618	0.888
80.286	1.088
78.535	1.296
76.782	1.53
73.279	2.045
62.275	3.675
54.773	4.644
47.273	5.591
39.771	6.413
32.568	6.963
28.967	7.153
25.366	7.25
21.765	7.159
18.953	6.98
16.138	6.714
13.325	6.308
10.51	5.691
8.76	5.163
7.006	4.498
5.256	3.718
3.503	2.903
1.755	1.99
0.876	1.475
0.438	1.137
0.219	0.872
0.0	0.0
0.219	-0.46
0.438	-0.628
0.876	-0.786
1.755	-0.919
3.503	-1.116
5.256	-1.272
7.006	-1.418
8.76	-1.57
10.51	-1.707
13.325	-1.861
16.138	-1.974
18.953	-2.077
21.765	-2.177
25.366	-2.252
28.967	-2.221
32.568	-2.171
39.771	-2.113
47.273	-2.045
54.773	-1.973
62.275	-1.904
69.775	-1.835
73.279	-1.804
78.53	-1.746
82.618	-1.746
84.238	-1.733
88.191	-1.534
92.144	-1.117
96.092	-0.571
100.0	0.0