## 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.

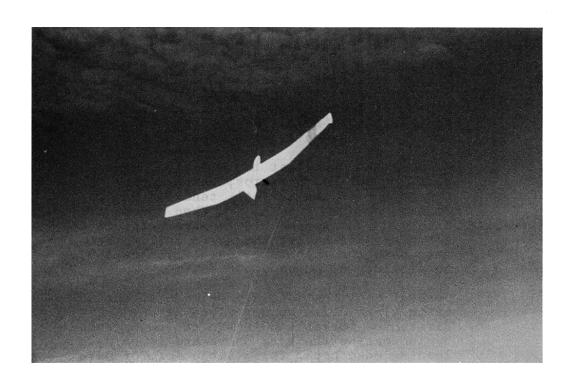
Always make sure that the elevator servos pull for up. The elevator, being a part of the reflex of the airfoil, tends to have a consistent down load on it. When speeds are high you want to be able to have reliable up elevator, and having the servo pull rather than push for that function eliminates the 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  $40^{\rm O}$  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 when competing in AMA events, and its very easy to build planks well below that minimum.



## AR 193-S75

99.661       0.0       66.364       -2.45         98.674       0.0       71.479       -2.46         97.108       0.018       76.339       -2.45         95.023       0.113       80.882       -2.35         92.452       0.227       85.05       -2.17         89.414       0.398       88.788       -1.88         85.945       0.625       92.048       -1.58         82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.77         73.484       2.462       98.64       -0.48	<u>X</u>	<u>Y</u>			
98.674       0.0       71.479       -2.46         97.108       0.018       76.339       -2.41         95.023       0.113       80.882       -2.3         92.452       0.227       85.05       -2.11         89.414       0.398       88.788       -1.86         85.945       0.625       92.048       -1.56         82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.7         73.484       2.462       97.003       -0.7         73.484       2.462       99.655       -0.21         64.052       4.265       100.0       0.0         59.186       5.052       5.824       49.458       6.485         44.673       7.005       39.979       7.363       35.402       7.556         30.967       7.566       26.696       7.418       22.62       7.131       18.78       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       0.465       0.901	00.0	0.0	$\wedge$	61.059	-2.454
97.108       0.018       76.339       -2.43         95.023       0.113       80.882       -2.33         92.452       0.227       85.05       -2.17         89.414       0.398       88.788       -1.86         85.945       0.625       92.048       -1.56         82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.77         73.484       2.462       98.64       -0.41         68.839       3.286       99.655       -0.22         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         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       <	99.661	0.0	1 \		-2.452
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89.414       0.398       88.788       -1.88         85.945       0.625       92.048       -1.55         82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.7'         73.484       2.462       98.64       -0.45         68.839       3.286       99.655       -0.25         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         59.186       5.052       100.0       0.0         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       1.699       1.690	5.023	0.113	! }	80.882	-2.315
85.945       0.625       92.048       -1.58         82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.7         73.484       2.462       98.64       -0.45         68.839       3.286       99.655       -0.25         64.052       4.265       100.0       0.0         59.186       5.052       5.624       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	32.452	0.227	·	85.05	-2.171
82.096       1.023       94.794       -1.16         77.923       1.675       97.003       -0.77         73.484       2.462       98.64       -0.45         68.839       3.286       99.655       -0.25         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         54.306       5.824       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.	39.414	0.398	i }	88.788	-1.884
77.923       1.675       97.003       -0.77         73.484       2.462       98.64       -0.49         68.839       3.286       99.655       -0.29         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         54.306       5.824       44.673       7.005       33.979       7.363       33.979       7.363       33.5.402       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 <td< td=""><td>35.945</td><td>0.625</td><td>i i</td><td>92.048</td><td>-1.553</td></td<>	35.945	0.625	i i	92.048	-1.553
73.484       2.462       98.64       -0.49         68.839       3.286       99.655       -0.29         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         59.186       5.052       100.0       0.0         54.306       5.824       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       1.699       0.901	32.096	1.023	·	94.794	-1.165
68.839       3.286       99.655       -0.23         64.052       4.265       100.0       0.0         59.186       5.052       100.0       0.0         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	77.923	1.675	1	97.003	-0.773
64.052       4.265       100.0       0.0         59.186       5.052       5.052       5.824         49.458       6.485       44.673       7.005       7.363         39.979       7.363       7.55       7.566       7.418       7.566       7.418       7.22       7.131       7.13	3.484	2.462		98.64	-0.455
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	8.839	3.286		99.655	-0.227
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	34.052	4.265	į	100.0	0.0
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	9.186	5.052			
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	4.306	5.824			
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	9.458	6.485			
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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	55.402	7.55			
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	0.967	7.566			
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	6.696	7.418			
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2.652 2.528 1.344 1.699 0.465 0.901	6.525	4.157			
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	1.344	1.699			
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	0.026	0.189			
0.0	0.0	0.0		•	
0.129 -0.379	0.129	-0.379	•		
0.819 -0.862	0.819	-0.862			
2.044 -1.312	2.044	-1.312	•		
3.791 -1.699	3.791	-1.699	1 /		
6.049 -2.019	6.049				
8.801 -2.27	8.801	-2.27			
12.026 -2.453	2.026	-2.453			
15.697 -2.576	5.697	-2.576			
19.778 -2.646			<b>i</b> i		
24.227 -2.672			i i		
28.998 -2.665			ií		
34.035 -2.636			<b>i</b> I		
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44.672 -2.547			U		
50.145 -2.504			7		
55.63 -2.472	5.63	-2.472			

 $\underline{\text{CJ-25}^2\text{-09}}$ 

X	Y		
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73.279 62.275 54.773 47.273 39.771 32.568 28.967 25.366 21.765	2.045 3.675 4.644 5.591 6.413 6.963 7.153 7.25 7.159	96.092 100.0	-0.571 0.0
18.953 16.138 13.325 10.51 8.76 7.006 5.256 3.503	6.98 6.714 6.308 5.691 5.163 4.498 3.718 2.903		
1.755 0.876 0.438 0.219 0.0 0.219 0.438 0.876 1.755	1.99 1.475 1.137 0.872 0.0 -0.46 -0.628 -0.786 -0.919		
3.503 5.256 7.006 8.76 10.51 13.325 16.138 18.953 21.765 25.366	-1.116 -1.272 -1.418 -1.57 -1.707 -1.861 -1.974 -2.077 -2.177 -2.252		
28.967 32.568 39.771 47.273	-2.221 -2.171 -2.113 -2.045		