Aero 101

This month, Aero 101 follows a slightly different format from the usual. I have two articles, one based on an exceptionally good presentation on servo selection by Stan Burak from High Flight, the official magazine of the IMAA (International Miniature Aircraft Association), and presented by kind permission of the editor, Taylor Collins, and the other, the result of a request from one of our members, on float design, based on articles by the late Chuck Cunningham in the now defunct Radio Control Modeler. So no credit to myself for either of them.

Stan Burak is a professional pilot (he flew for TWA) and designed and built his own homebuilt airplane. He used charts for determining control surface hinge moments which come from the FAA requirements for certification, FAR (Federal Aviation Regulations) 23. I have often thought of adapting these myself to the model aviation field, but never got around to it, but Stan has done an excellent job, so here is a summary of his results. The chart below shows the amount of torque required to operate a control surface successfully.

Control Surface Torque Required (in Inch/Ounces)
For 30 degree deflection of control surface

Control Surface Chord (Average)

Control Surface Span	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8
4						28	37	47							
6				22	31	42	55	70	86	104	124				
8			18	29	41	56	74	93	115	139	166	194	225	259	294
10			23	36	542	70	92	116	144	174	207	243	282	323	368
12			28	43	62	85	110	140	173	209	248	292	338	388	442
14		18	32	50	72	99	129	163	201	244	290	340	395	453	515
16		21	37	58	83	113	147	186	230	278	331	389	451	518	589
18		23	41	65	93	127	166	210	259	313	373	437	507	582	662
20		26	46	72	104	141	184	233	288	348	414	486	564	647	736
22		28	51	79	114	155	202								
24		31	55	86	124	169									
26		34	60	93	135	183									
28		36	64	101	145	197									
30	17	39	69	108	155	211									
32	18	41	74	115	166										
34	20	44	78	122	176										
36	21	47	83	129	186										
38	22	49	87	137	197										
40	23	52	92	144	207										

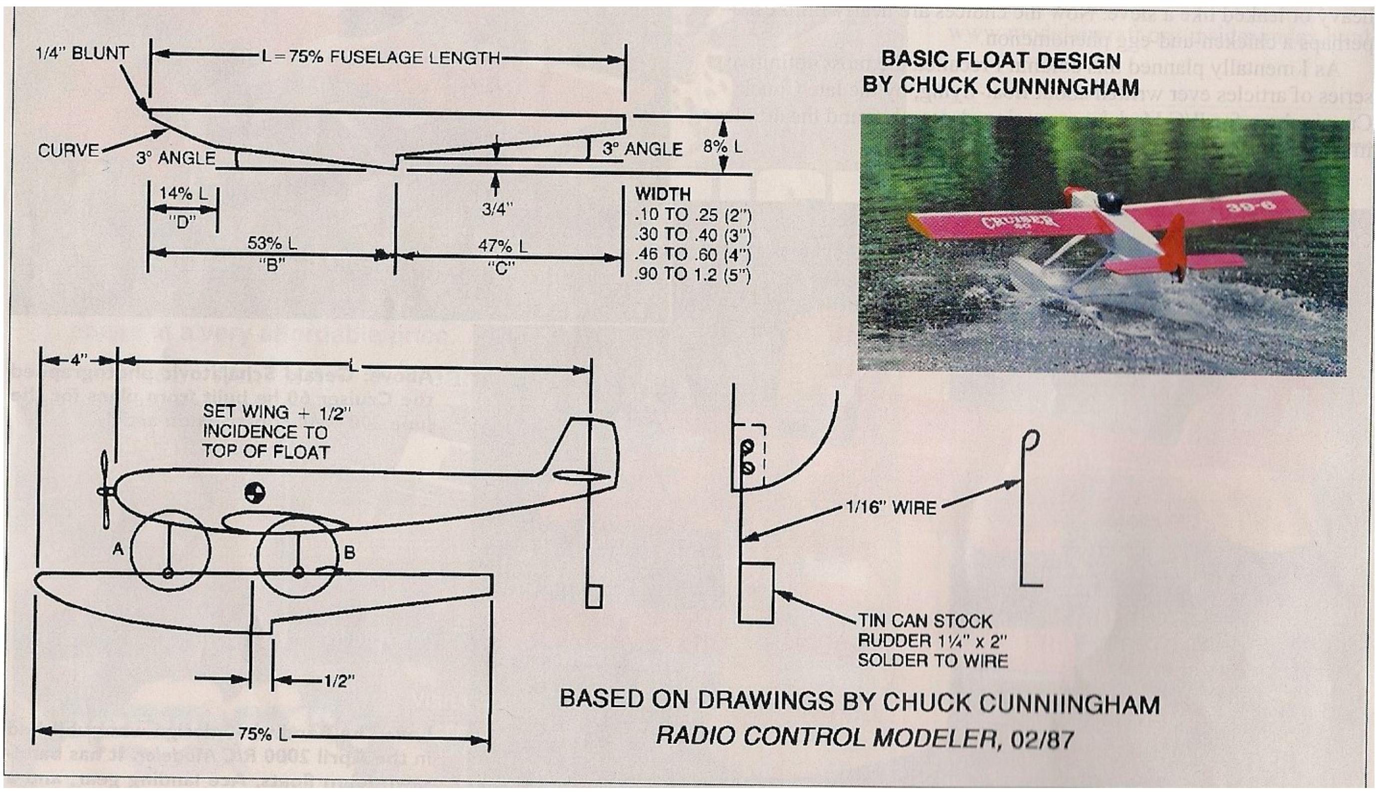
Wing Loading Multiplier
24 oz. = .75
32 oz. = 1
40 oz. = 1.25
48 oz. = 1.5

Speed Multiplier
75 mph = .5
100 mph = 1
125 mph = 1.6
150 mph = 2.4
175 mph = 3.2
200 mph = 4 .2

This chart tells you exactly how big a servo you will require based on the size of the control surface. Note that the article was written from the point of view of IMAA-type aircraft, which are normally larger than 80" wingspan. So the wing loading is assumed to be 32 ounces/square foot and the flying speed 100 m.p.h. For smaller wing loadings, like most of our airplanes, simply scale down by the ratio of the wing loading, and for lower speeds, scale down by the square of the speed, as Stan has shown in the box. Note that he has quite reasonably rounded off some of these numbers, as we certainly don't need three-figure precision in determining which servo to use. There is a common error in the printing of this table which doesn't affect the results. Torque is of course in inch-ounces, not inch/ounces, but this is a very common printing mistake. Stan has another very useful chart which goes into the effect of aerodynamic balances like the typical overhang on a Piper Cub rudder, but this is a refinement which most of us do not need. Using the chart above should open some eyes as to what sizes of servos really are needed on our model airplanes. For further details, have a look at his original article in the summer issue, 2010, of High Flight, volume 31, No. 2.

Float design

I was asked by a club member if I would write an article on float design for our model airplanes. I really don't feel that I have any particular expertise in this area – we didn't make too many stealthy seaplanes in the Lockheed Skunk Works – so I looked through some old magazines and came up with this very good chart which was later published in a Model Aviation article in 2007. I believe that our member wanted to put floats on a Pico Stick or some such vehicle, but the chart below can be applied to just about any simple twin float design. I would guess that the initial article was based on a 0.40 to 0.60-sized airplane, based on the author and its date of publication. The only reason that I mention this is that there is a mixture of percentages and inches in the chart, and it looks as if the linear dimensions are appropriate to the size airplane I suggest. So go by the percentages primarily, and use your judgment about the linear dimensions.



My view, for what it's worth, is that this drawing makes a very good basis for float design for most sports model aircraft, and I can't see any obvious way to improve on it.

So that concludes this month's newsletter.