Calculation of Optimum C.G. Position

by Steve Riley

The following article was found in the archives of local member Jeff Dunlap. Riley describes a method set forth by Rene' Jossien which was published in the French Quarterly Vol Libre 1977-91.

I have seen F1B models (Tom Cashman's) set up with this method and they do have excellent trim stability. I also ran this formula on an AMA power model, Jim Clem' s Witch-Hawk; the formula comes out with a C.G. of 71%. The plans call for 70%. That's close enough for me.

This method appears to allow for the many subtleties of static longitudinal stability. Most methods approximate the neutral point and allow the designer to choose the margin of stability based on personal experience. This method takes care of everything, and in checking it against several models, is quite accurate.

CG = WC +[(SC)(SA)(MA)(PS)] ÷ [(WA)(WA)]
where:

CG = center of gravity, percent of average wing chord aft of leading edge
WC = wing coefficient = 20 + (A+B+C)
SC = stabilizer coefficient = 25 + (D+E)
SA = stabilizer area in sq inches
WA = Wing area in square inches
MA = moment arm. distance from wing L.E. to stabilizer L.E. in inches
PS = projecting wing span, exclusive of the fuselage width, with dihedral shortening

Wing Coefficient Variables

A = position of wing relative to fuselage centerline (FCL)
- +2 if below FCL
- +3 if even with FCL
- +4 if slightly above FCL
- +5 if small pylon (less than 2.75" above FCL
- +6 if high pylon

B '" wing airfoil
- 0 if symmetrical
- +1 if flat bottom with upsweep at LE
- +2 if flat bottom
- +3 if slightly cambered
- +4 if highly cambered

C = Type of model and flight pattern

	Scale, Coupe	F1A-F1B	F1C
windy weather/good climb	-6	0	+6
all weather/ave(average performance	-4	+2 (HLG)	+8
calm air best glide	-2	+4	+10

Stabilizer Coefficient Variables

D = vertical fin arrangement

0 if single fin
+1 if twin fins (small area)
+2 if twin fins (large area)

E = stabilizer airfoil

0 if symmetrical
+1 if flat bottom with upsweep at LE
+2 if flat bottom
+3 if slightly cambered
+4 if highly cambered (or VIT on FIC's)

And as with almost all things pertaining to models, you must make the final adjustments after testing