Case		Fus width	Wing LE to tail hinge	Wing span	Tail span	Tail Area	Stick fixed n.p.	**Stick free n.p.**	Comments
Kr2	F	36”	114.5”	116”	72”	11.17	12.75	**11.8**	Worst case with 1.3 Lbs/g at aft cg of 11.8
Kr2 + Marks tail	E				84”	13.41	13.8	**12.3**	NB only minor stick free improvement rel. stick fixed
Kr2 + Mole tail	E				94”	14.92	14.75	**13.95**	5” horns gives **4.3** Lbs/g at 11.8 ins aft LE
Kr2S	G	36”	129.25”	23 ft	72”	11.61	13.5	**12.2**	Stick free n.p. improved only by 0.4” over kr2,1.3 Lbs/g With cg of 11.8 this a/c has 2.1 Lbs/g (50% better than Kr2)
Kr2S + Marks tail	H				84”	13.41	14.7	**13.0**	NB ditto comment above
Kr2S + Mole tail	H				94”	14.92	15.75	**14.9**	5” horns gives **4.8** Lbs/g at 12.2 ins aft LE
Kr2SLang	I	39”	132.75”	23ft	84”	13.41	14.3	**12.55**	Down 0.45” on ‘kr2S + Mark tail’ because 16% wing cost 0.2”, wider fuselage cost 0.5”,longer fuselage saved 0.3”, on stick free np; but still better than stock kr2S. 1.7 Lbs/g
Kr2Slang +Mole tail	I				94”	14.92	15.35	**14.5**	5” horns gives 3.9 Lbs/g at 12.55 ins aft LE Stick free np intermediate between Kr2 & Kr2S Mole tails

GENERAL COMMENTS

The numbers are indicative only; but probably reliable for comparitive purposes. Do remember that they are obtained for the Power-off case. The de-stabilising effects of power will bring the neutral points (n.p.) forward. The numbers in the table relate to speeds from say 125 mph and upward.

I have listed the stick fixed n.p. for interest only. Notice that the stick free n.p. is always further forward. Therefore the limiting case for the aft c.g. is the stick free n.p. It is possible, if you are completely crazy, to try to fly with the cg aft of the stick free n.p. but this is similar to a circus trick and it is VERY dangerous. The stick free manoeuvre margin is what makes it possible at all, and this depends upon air density.

So the stick free n.p. is the important criterion; and indeed the cg should be somewhat forward of this to allow for power effects.

The aft cg of the stock KR2S is some .4” aft (ie better than that) of the KR2. This is a pretty small amount!

I wouldn’t expect that the KR2S would feel that much better than a KR at the same cg, unless the cg was close to 11.8” in which case the KR2 would have 1.3 Lbs/g (very twitchy) whereas the KR2S at the same cg would feel feel much better at 2.1 Lbs /g (quite twitchy) some 50% better.

Mark's modifications give him another .35" so his a/c is improved almost as much again as the KR2S has improved over the KR2. With the cg at 11.8 the stick free n.p. of the KR2, Mark has 3 Lbs/g (light) compared to the KR2 1.3 Lbs/g (very twitchy) or 2.1 Lbs/g of the KR2S (twitchy).

Mark's modifications to the Tail are excellent. This tail would add 0.8" to the aft cg limit of the KR2S and 0.5" to the aft limit of the KR2.

The aft cg limit on Mark's bird, however, is not as good as the stock KR2S because of the de-stabilising effect of the wider fuselage and the 16% laminar flow wing despite the longer tail arm.

MOLE TAIL COMMENTS

Notice that when moving from the stock a/c to the a/c fitted with Mark's tail that both n.p's go aft (ie an improvement). But the stick fixed n.p. goes aft a lot more than the stick free n.p. travels aft. This is undesirable because we cannot take advantage of the stick fixed n.p. We are restricted by keeping forward of the stick free n.p. because it is further forward.

So bigger tails and moment arms, while increasing the tail volume and thus moving the stick fixed n.p. nicely aft, do not bring home the bacon. This is a direct result of the tendency of the elevator to float with the prevailing airflow.

The point about the unshielded horns is that they greatly counteract this tendency of the elevator to trail with the airflow; the elevator with the 5" horns does trail a bit but nothing like as much as it would without the horns. These horns, being forward of the hinge line and very exposed at the tip of the tail, are most effective in applying a counter moment about the hinge line that partially counteracts the moment around the hinge line when a control movement displaces the elevator into the local airflow.

Since the floating tendency is much reduced the stick free stability is not that far removed from the stick fixed stability.

Now compare the Langford Tail and Mole Tail cases; the latter simply adds 5" horns at the elevator ends. Whereas the extra area helps to push the stick fixed n.p. back as you would expect, the stick free n.p. moves back much further still. And this is what we want to achieve

If a kr2 pilot changes to the Mole tail then at the old aft cg of 11.8 he would find the stick force would have increased from 1.3 Lbs/g to 4.3 Lbs/g ie by a factor of over three times; a welcome gain. In addition, the allowable aft cg travels backward by over 2", a very substantial improvement. The old cg range of .
from 8" to 11.8" (some 3.8") has increased dramatically to the range 8" to 13.95" (some 5.95") or some 50% improvement.

If a kr2S pilot changes to the Mole tail then at the old aft cg of 12.2 he would find the stick force would have increased from 1.3 Lbs/g to 4.8 Lbs/g ie by a factor of almost four times; a very welcome gain. In addition, the allowable aft cg travels backward by 2.7", a very substantial improvement. The old cg range from 8" to 12.2" (some 4.2") has increased dramatically to the new range 8" to 14.9" (some 6.9") or 65% improvement.

Mark's bird would also improve from a stick force of 1.7 Lbs/g to 3.9 Lbs/g at a cg of 12.55". The cg range expands from 8" to 12.55" (some 4.55") for his tail design to 8" to 14.5" (some 6.5") .

DIY mega horns

Suppose a bright KR owner decides to put mega horns on his stock KR while waving two fingers at GLA. Well the best he will achieve is to bring the stick free np as far aft as the stick fixed case for the old tail Plus horns (it is technically possible to get more than this but flying qualities are unpleasant although not particularly dangerous). Well yes, I could do the sums (but I have too many DAYS invested in this analysis already). I would guess that the maximum improvement would be about 50% of what we can offer him.

Caveat
These conclusions represent my best efforts. They support the 'one size fits all' conclusion which also makes great commercial sense. They are just estimates. Careful flight testing is essential.