STABILIZER SIZE AND MODEL FLIGHT

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For most modelers, adequate longitudinal (fore and aft) stability is easily achieved. Those annoying nose up and down oscillations have been licked with a combination of forward CG and a larger horizontal tall. **The usual rule of thumb of a horizontal tail area equal to at least 25% (30-33% is even better) of the wing area does the lob quite well**. True full scale tail-sizes of about 15% just won't do it on models. Why aren't full scale horizontal tails made larger? Surely pilots would appreciate the greater stability - close to that of an auto-pilot - or would they?

There is a catch. Greater inherent stability produces reduced maneuverability. At about the 25% point an airplane becomes reluctant to dive steeply, no matter how much force the pilot applies to his controls. For example, when employed by the Royal Aircraft Factory on its BE2c in WW I, complaints were fierce. English airmen died because they were unable to dive away from attacking German aircraft. Upon investigation, the BE2c was officially declared a "non-diver". The commotion strongly influenced full scale design thereafter. Result: small full scale horizontal tail sizes.

Model designers know this. Making the horizontal tail bigger is an obvious and necessary step. Problems arise, however, when the vertical tail is made larger as well. Doing so maintains a sense of scale proportionality - if only the horizontal tail is enlarged, the vertical tail seems too small. The problem is that making the vertical tall larger will often lead to spiral (lateral or side-to-side) instability. **We struggle with two basic forms of lateral instability: that sensed under power and that developed in glide.** These differ because the prop blast itself is a powerful factor in lateral stability. Its presence or absence has much to do with the result.

Prop blast doesn't go straight back; it spirals, reflecting the motion of the propeller. The usual effect of too large a vertical tail, taken together with motor torque, is to force the model into a left bank. Unless corrective action is taken, the final result may well be a spiral dive into the ground. fortunately, for most models the cure Is simple: offsetting the prop a few degrees to the right, or adding right thrust.

When in the glide mode, with torque and prop blast no longer. significant, oversized vertical tails can produce a delayed spiral dive either to the left or right. Because the disturbing force is small, it sometimes takes many seconds for the instability to become clear. In some models, only a lengthy thermal flight will force the slight "divergence" to reveal itself. We tend to write off such late flight oddities as flukes, owing to some peculiar wind gust. Sometimes this is the case, but sometimes it's not. If you see it on two or more separate flights, the chances are that the instability is real.

As to the cure, some believe in potent combinations of washin and washout. I don't. There will always be some gust/breeze/thermal combination that will unravel those washin/washout settings to freshly recreate the unwanted spiral dive. Instead, **I think the only genuine solution is to chop the vertical tail down in size to something acceptable. It should be less than scale in size - certainly never more.** Unfortunately, the process is no fun. Removing the vertical tail is never easy and reworking it is a nuisance. When all is said and done, it will usually seem too small.

Can this resizing be overdone? What happens if the vertical tail is made too small? A new form of instability then arises, called Dutch roll in which the model rolls slightly clockwise, then counterclockwise, etc. This happening is rare; I've seen it exactly once, and then only by flying , a model after having removed its entire vertical tail. As a practical concern, we needn't worry about this one. With full scale vertical tails so large, most real airplanes are spirally unstable. Oddly, most pilots don't complain. They like that feeling of being in control that is granted by a large vertical tail.