"TO STALL OR NOT TO STALL"
From the internet –- edited by the Windsock

Understanding the stall characteristics of your model aircraft goes a long way in preventing a stall situation when you don't need it. It is therefore important to understand the aerodynamics.

Models without wash-out at the wing tips and with a considerable amount of control surface movement are able to deliver great aerobatic performance but are very prone to stalling at the wrong moment. The worst of unscheduled aerobatics is the sudden and often vicious "snap-roll" on the gentle application of "up elevator." This can occur in level flight, but in some aerobatic aircraft, a sharp input from a dive can result in the same problem! And the speed at which the model is travelling will not necessarily prevent the problem from occurring.

> ***To stall or not to stall, that is the question:-***
> ***Whether 'tis nobler in the mind, to suffer***
> ***the ups and down of outrageous flying;-***
> ***Or move the trims against a sea of troubles,***
> ***And by resisting—end them?"***
> ***"To prang, - to fly no more:-***
> ***And by flying we continue the heartache***
> ***and the many natural shocks that balsa is heir to,-***
> ***'Tis a consummation devoutly to be wished***
> ***to stall to stall perchance to prang:- Ay, there's the rub."***
> ***(My sincere apologies to Bill Shakespeare!)***

Here are two possible situations: On base leg of the circuit, the pilot commences a 90 degrees turn, using some "up elevator" as is normal; the aircraft flips over onto its back, and the ailerons do not respond. Or this one: The pilot is attempting an inside square loop, as the model finishes the vertical climb, the pilot pulls back on the stick to begin the inverted leg; equally amazed at the resulting "snap roll". The nose falls though, and as the speed builds up rapidly, the pilot again puts in "back stick" as the ground is unexpectedly closer and suddenly produces another "snap roll" situation resulting in an accelerated stall with the likely outcome a smash into the ground! Either way you analyse it, it is still a stall.

In both situations the stall occurred from the same error in flying, i.e. an excessive "angle of attack" for the speed being flown. Either way, the nose was not dropped enough to maintain flying speed. In the first situation, the pilot did not drop the nose enough to maintain flying speed, and in the second situation the high speed stall occurred when the input was too much for the flying speed of the model.

How did this happen? Ailerons are used to correct a bank aren't they? Not in this case–because of the condition which is called **"adverse yaw".** Here's why it occurs and why it never bothered you so long as you flew trainers, sports models or Stand-off scale models. What it amounts to is that the wing which is on the outside of the turn (the wing which rises) has its aileron deflected downward, and this creates lift. Since lift creates drag (pull the nose of an model up, it slows down) the wing on the outer side of the turn is actually dragging backward from the line of flight, and the nose of the model begins to rise in respect to the horizon. You are now yawing against the turn. The longer the wing, the worse the yaw. The aircraft is also going too slow, since you are now going through the air slightly sideways. **More drag!** The reason we don't usually experience this condition is because most of our model aircraft are designed to eliminate adverse yaw, whether or not you realised it. Several things, or a combination of things, have been used: Strip ailerons– these require less deflection than "barn door" ailerons and since the prop wash over the root of the wing does a lot of the work away from the tips, the adverse yaw is reduced greatly. Aileron differential– the down going aileron is rigged to deflect less than the up going. This equalizes the drag, and with proper adjusted differential, the yaw problem can be completely eliminated.

Going back to our first situation, when turning onto final the slow speed snap occurred at the 90 degrees bank, you can now see what happened. The lowering of the aileron didn't raise the stalling wing, it aggravated the problem! It simply added more drag to the wing, compounding the situation. What was needed was the input of rudder. The rudder hasn't stalled, and it will lift the wing. (Incidentally when you stall a model into a snap, you'll swear that your aileron servo failed, It didn't! It was the wing that stopped flying!)

As the angle of bank increases, the stall speed of the model increases. The steeper the bank the more you have to prevent the nose from rising due to adverse yaw. You can either decrease the angle of bank, to prevent the stall, or coordinate your turns with the use of rudder. This takes some time to produce a balanced input, but this will make you a better pilot. (Just watch Tony Small!)

The second type of surprise snap related accident occurred, as we saw, not at low, but at high speed. This is the accelerated stall. It's not caused so much by what you don't do, but it is caused by too much elevator travel, which forces the wing past it "critical angle of attack." The answer is less elevator input or rate switches.

RATE SWITCHES & EXPONENTIAL

Set the elevator travel so that on low rates you have less throw, and on high rate you increase the throw to give you control during abrupt aerobatics . The only time you'll need the extra travel will be on sharp manoeuvres and snaps, since the spins can be entered with a lot less throw and, with careful speed management, you ought not to fall out of the air. You'll be more likely to achieve a good landing on low rate elevator as well. This can also be achieved with the use of exponential rates. Computer transmitters can easily programme it into your set up and will produce less sensivity at small inputs and more sensivity at higher inputs.

There are two more basic scenarios, the first is the stall on take off, when the model is flown off the ground prematurely before safe flying speed has been achieved, one wing drops, the pilot corrects with the use of aileron. This in fact aggravates the situation, when the use of rudder would have allowed the model to recover, but the use of aileron actually compounds the situation.

The second is the landing approach when on short finals, one wing tip stalls prior to the root centre stalling, with the result of a likely cartwheel situation. Again, the answer is faster landing speed, the use of rudder, and more washout in the design of the wing in the first place.

The answer is to practise as often as possible, fore-armed with the understanding of the problems involved and the knowledge to avoid a stall situation.