

## Factors which affect Take-off

There are four principle factors which affect the effective take-off of an aircraft.

These four factors all combine together to impact on the ability of the aircraft to take to the skies in a safe and predictable way. Every propeller powered aircraft suffers from these effects, whether it be a model, or a full size.

**Prop Wash:** As the propeller rotates, it creates a vortex behind it. This is similar to that of a vortex which can be seen from the back of a Formula One racing car in the wet. The vortex, or prop wash, spirals off the tips of the propeller and spins down the fuselage until it hits the left side of the fin and rudder. This force swings the tail of the aircraft to the right and therefore points the nose to the left, causing a swing on take-off.

**Torque:** This is the effect of the fuselage rotation versus the engine rotation. When seen from the back of the aircraft, the engine rotates clockwise. This causes the opposite reaction, of the aircraft wanting to rotate anti-clockwise. Therefore the aircraft wants to rotate to the left; thus adding to the left swing effect. Torque can be affected by the size of the prop and the model, and varies according to the type of aircraft.

**Drag:** This results as an effect of all the other factors, but specifically the two above. The effect of the torque on the aircraft naturally wants to push the left wheel into the ground, unbalancing the aircraft in such a way as the left wing drops very slightly and the right wing rises, this also adds to the left bias of the aircraft.

**Gyroscopic effect:** This is quite a difficult effect to describe in words. It can be shown more effectively by spinning a bike wheel and then trying to turn it through 90degrees. The effect is to place a force on the aircraft which is 90degrees to the propeller. Therefore, in the case of a tail dragger, when the aircraft is up on its main undercarriage, there is a gyroscopic force placed on the aircraft, which forces it left. This was quite a common cause of crashes during WWI, as rotary engines suffered massively with gyroscopic effects and most pilots were killed taking off, than at any other time.

### External factors

There are of course a number of external factors, which can cause an aircraft to swing on take-off.

Crosswinds

Bent or twisted undercarriage

Sticking wheel

Out of trim

I have had several aircraft which suffered with problems on take-off.

My 40cc Spitfire, would always swing left and on the ground when running up, it would push the left wheel into the ground, leaving an indentation. This was the torque effect.

My 50cc Chipmunk requires full right rudder to keep it straight on take-off. Without it, it will swing violently to the left.

### **Ways to avoid problems on take-off**

Apply the throttle slowly, don't slam it open.

Use plenty of rudder to track the aircraft straight.

Make sure the undercarriage is in correct alignment and the wheels are tracking straight ahead.

Ensure the aircraft has enough speed to fly safely; don't force the aircraft into the air.

Try not to bank steeply when taking-off, this could induce a spin, or could result in the aircraft sliding into the ground and cart wheeling.

Chris Berry

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