

### **Safe airspeeds©**

The pilot is a controller of energy. In some situations there is a considerable surplus of energy such as while taxiing. In some takeoff situations there is a deficiency that requires the conservation of energy through the use of ground effect. Level flight provides opportunity to use weather and wind to enhance range and speed. Descents and landings require the pilot to be able to convert the speed of the aircraft and the energy supplied by gravity into a non-lethal ground contact called a landing. The relative safety of any speed depends on the pilot's ability to control the maneuvers performed. A speed that is safe for one level of piloting skill will be unsafe or suicidal at lower level of skill. Aircraft POH speeds are tested and proven at time of manufacture to be safe for average piloting levels. A student pilot is not soloed until he has attained such a level.

In the beginning and the end there is taxiing. Your taxiing speed at most airports is posted at fifteen miles per hour. Even this speed may be too fast when it causes erratic swerving and abrupt application of brakes. An aircraft will not turn unless the wheel is rolling. Varied brake pressure and power use can make turns smooth wide arcs or sharp turns. Straighten the nose wheel as you come out of the turn to avoid side loads. Taxi slowly until you learn to control brake and power. The absolute safety sought by the questioner does not exist at any speed. Most aircraft accidents occur while taxiing. When wind velocity get above 20 knots the margin of safety, even with correct control positions and slow taxi speed, decreases dramatically.

There are several safe takeoff speeds, one for headwinds, one for cross winds, one for soft fields, and one for short fields. Absolute safety again does not exist at any speed but relative safety exists in acquiring the POH recommended speed prior to lift off. The correct application of the controls allows you to remain airborne without further ground contact. Excessive rotation, the lifting of the nose, can cause a lift off so slowly that a climb cannot begin without lowering the nose. This means you are behind the power curve and in a precarious situation. Not raising the nose enough on takeoff allows relatively small tires to reach damaging speeds and excessively stress the shimmy damper of nose wheel. In normal headwind takeoffs get the nose wheel off as soon as possible but set the nose attitude for liftoff as suggested by the POH.

The nose wheel is not lifted off in crosswind except as required to prevent a shimmy. The idea here is to keep the aircraft on the ground until a speed slightly in excess of normal is acquired. At this time the yoke is leveled and quickly moved so as to 'hop' the aircraft into the air and flown to prevent further ground contact. At the same time rudder is applied to crab the nose into the wind. Do not attempt to climb until POH climb speed has been attained. Adjust the crab angle to give a flight path along the runway.

The soft field takeoff requires that lift off be attained as quickly as possible to reduce the drag of the tires in the soft surface. Once in the air the aircraft is held in ground effect to make acceleration easier and faster. At climb speed and around 200 feet any flaps should be removed.

The short field takeoff requires that the plane be accelerated along the ground in a minimum drag (level) configuration until reaching slightly

below lift off speed. The nose is raised to a previously determined  $V_x$  attitude and allowed to climb at  $V_x$  until above the fifty foot FAA tree.

Any takeoff speed must be sufficient to keep the aircraft airborne after liftoff and low enough to prevent accumulative damage to the airframe. All takeoff speeds are indicated air speeds not ground speeds which are influenced by wind direction. The safety of takeoff speeds has as much to do with control applications as with the speeds involved. The speed must allow the pilot to keep the aircraft under control and in the air.

Climb speeds are critical in terms of safety only in so far as they get you over an obstacle or get you the most altitude for the time flown. Once you are at a safe altitude the airspeed can be varied to suit the purposes of the flight. Every pilot should have the ability to select an attitude for a particular trimmed climb speed and fly hands off. Once you can do this for  $V_y$  other speeds are relatively easy.

Transitional speeds in level flight require that the pilot be able to vary the speed, power, configuration, and attitude of the aircraft. There is a whole range of level attitude speeds ranging from minimum controllable to full power cruise. The configuration of trainers will vary from full flaps to no flaps. In complex aircraft the landing gear, propeller, and other features offer variety. The standard cruise speed is usually attained at a 75% power setting. This setting will vary again according to desired range, fuel use, and airspeed. The better a pilot can fly his aircraft through this range with no change in altitude the safer will be the flight. Inability to make the flight changes efficiently makes any airspeed potentially unsafe.

Descent speeds have a range from the minimum controllable to redline. A minimum controllable descent will get you down over the least distance. The range from this to the best glide speed, as configured will enable you to control your sink rate over distance. You will be able to make steep approaches with full flaps and power off by raising the nose and lowering the airspeed. In the same situation diving for the runway will increase the speed and cause you to go a greater distance. The cruise descent will increase fuel economy, allowing you to convert altitude into airspeed and distance. A descent that uses no power can shock cool the engine. At some point such a sudden cooling of the engine will cause piston damage and engine failure. Speeds in the yellow arc should be avoided where turbulence exists. Beyond the redline you become a test pilot.

Landing approach speeds from the POH have the margins of safety predicated on medium banked turns, stabilized airspeeds and coordinated controls. The more an approach speed varies from the POH standard the greater the potential hazard. Approach speeds are changed into roundout/flare speeds designed to stop the descent and provide a reasonably controlled attitude and minimum landing distance. For landings there are no absolutes of speed, safety or success. Making a mistake in judgment in any of the landing variables can easily be compounded into an accident. One purpose of instruction in flying or in teaching anything is to prevent mistakes from growing into something serious.