

# take-off

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## chapter 4

The take-off is the moving of the aircraft from its starting position on the runway to the point where it leaves the ground with flying speed. Since the take-off involves both ground and in-flight operation of the aircraft, you must be able to make the transition from the ground functions of the controls to their in-flight functions with a maximum amount of smoothness and coordination. Skill in blending the ground and in-flight functions of the controls, while you are taking off, will greatly improve your ability to maintain directional control of the aircraft on the runway.

Since a good take-off hinges around the take-off attitude of the aircraft, it is important that you know how to determine this attitude. The ideal take-off attitude requires minimum pitch adjustments to establish the desired climbing attitude after the aircraft becomes airborne. With this thought in mind, you should easily understand that it is practically the same as the 110 MPH climbing attitude. In this attitude the tail-wheel is approximately six inches off the ground. This is known as a tail-low take-off attitude. Prior to take-off practice, your instructor will show you the proper take-off attitude.

### APPLICATION OF POWER

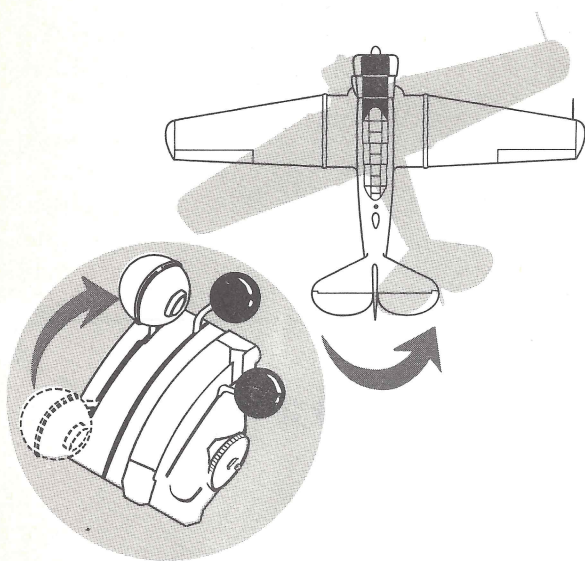
First, clear the area all around you to be certain that you are not in the take-off or landing lane of another aircraft. Align the aircraft with the runway to straighten the tail-wheel. Select ground objects or points on both sides of the nose of the aircraft to use as reference points for maintaining directional control on the take-off. Release the brakes and open the throttle *smoothly* to the sea-level stop. As you apply throttle, maintain directional control by smooth, positive rudder application.

A sudden application of power will cause the aircraft to yaw excessively to the left because of torque effect. To prevent sudden swerving of the aircraft, you will have to apply the throttle smoothly.

### THE TAKE-OFF ROLL

You should hold the elevator control in the neutral position while the throttle is being smoothly advanced to the sea-level stop; hold the same neutral position throughout the initial part of the roll. Continue to maintain directional control with smooth rudder application.

Since the tail surfaces are lighter and because air is forced back over them by the pro-



*Excessive Yaw Resulting from Rapid Throttle Application.*

peller blast, these surfaces will become effective or “start to fly” first. Thus, as the speed of the take-off roll increases, you will begin to feel pressures on the flight controls — particularly the elevators and rudders. Along with this, you must make progressively smaller corrections in order to maintain directional control.

As the aircraft approaches flying speed, the nose will start to descend if the elevator control is in a neutral position, and the proper take-off trim was established.

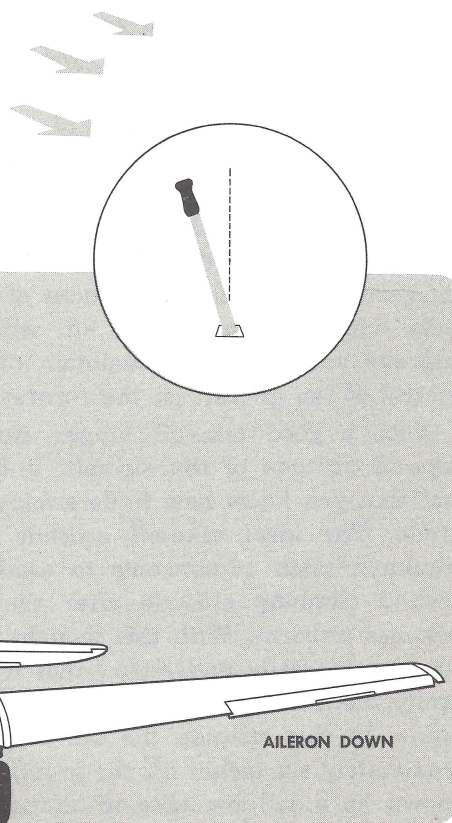
When the take-off attitude has been at-

tained, hold it constant throughout the remaining part of the ground roll with whatever elevator pressure is necessary. Keep the wings level by applying aileron pressures as necessary.

#### **TAKE-OFF (Cross-Wind)**

The cross-wind take-off technique is like the normal take-off, except that aileron pressure should be used *into* the wind to keep the wings level during the take-off run.

It is essential that you anticipate cross-wind effects on take-off by checking the wind tee. If a cross-wind is indicated, apply aileron pressure *into* the wind as you start the take-off roll. As the ground speed increases and the ailerons become effective, it may become necessary to vary this pressure to keep the wings level. This aileron pressure will be necessary in many cases because the up-wind wing will



*Aileron Position for Crosswind Take-off*



develop more lift in a cross-wind, causing it to "fly" or lift sooner than the down-wind wing.

If the up-wind wing is allowed to rise, thus presenting more impact surface, a "skipping" effect may result. This is a series of very small bounces, caused by the aircraft's attempt to fly and then settling back to the ground. At the same time, because of the effect of the cross-wind's attempt to move the aircraft sideways, these small bounces appear in the form of a side "skip." This skipping imposes side stresses on the landing gear which can result in material failure. In addition, the tendency for the aircraft to weather vane (streamline itself into the wind) is increased during a skip. If you hold sufficient aileron pressure into the wind to keep the wings level, and also maintain directional control, the aircraft will fly itself off the ground. This will eliminate the skipping effect.

#### LEAVING THE GROUND

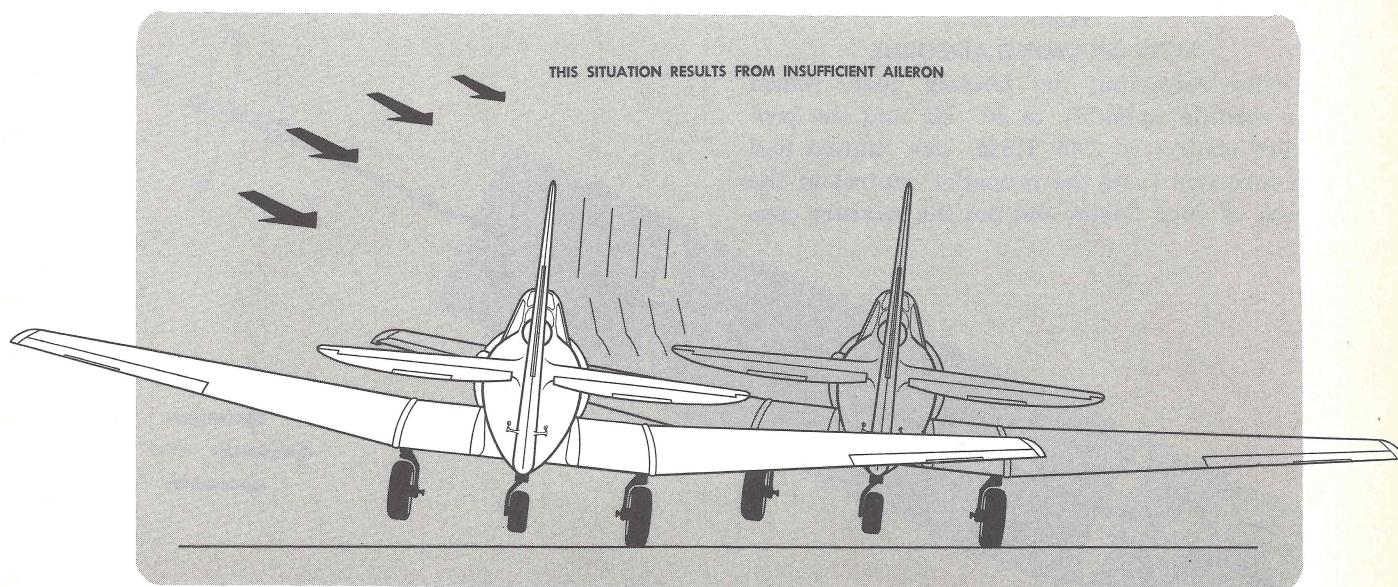
Allow the aircraft to fly itself off the ground; don't pull it off with excessive back-stick pressure. Give it time to fly off. Do not rush the aircraft. When it is ready to fly, it will come off the ground smoothly with ade-

quate flying speed. Just remember to hold the take-off attitude constant during transition from your ground roll to airborne flight.

At this stage you are primarily concerned with leaving the ground with the correct attitude and airspeed, and in maintaining directional control. If you pull the aircraft off the ground by using too much back-stick pressure before flying speed is reached, you may settle back to the runway. By attempting to pull the aircraft off the ground after flying speed is reached, you may also cause the nose to rise to an excessively high-pitch attitude immediately after leaving the ground. This could result in a stall, causing the aircraft to fall back to the ground very forcibly and possibly in an unfavorably abnormal attitude.

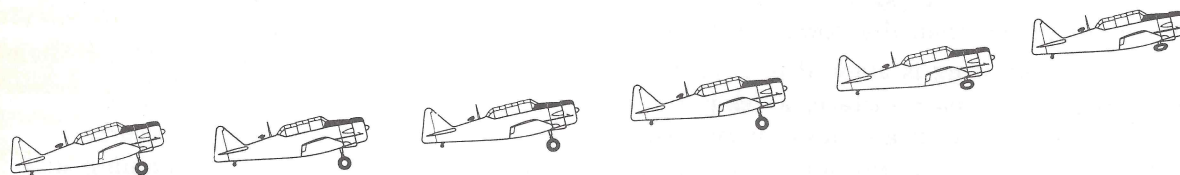
Conversely, if you fail to hold sufficient back-stick pressure to maintain the correct take-off attitude after becoming airborne, and allow the nose to lower excessively, the aircraft may settle back to the runway. This happens because the angle of attack is lowered and the lift is decreased.

Once the aircraft leaves the runway, it picks up speed rapidly. When you are certain that



*Skipping on Take-off*





the aircraft is airborne, and will remain airborne, retract the wheels.

#### LEAVING THE GROUND (CROSS-WIND)

Remember, during a cross-wind take-off, you were holding a certain amount of aileron pressure into the wind during the take-off roll. When the aircraft leaves the ground, continue to hold enough of this aileron pressure to cause the aircraft to bank and establish a slight turn. Sufficient rudder pressure should also be applied to coordinate the turn. Care should be exercised to make this bank very shallow, as the lowered wing could possibly strike the ground. When you have turned sufficiently to counteract all drift, roll the wings level with coordinated rudder and aileron pressures, and you will have automatically applied your initial drift correction. Continue to climb straight ahead in this resulting "crab" attitude.

#### TECHNIQUE

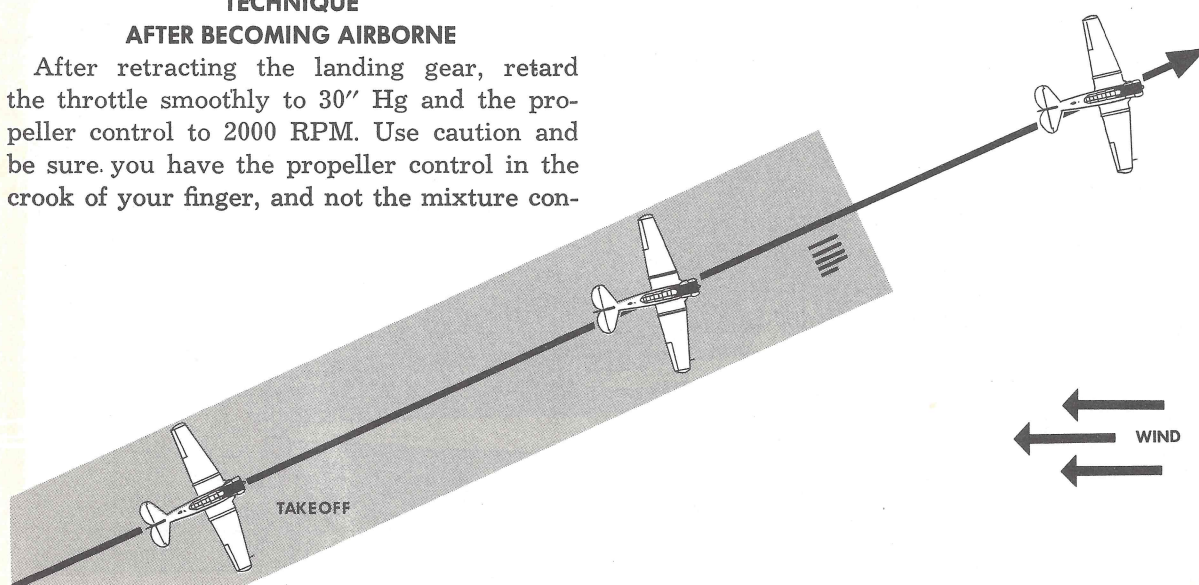
##### AFTER BECOMING AIRBORNE

After retracting the landing gear, retard the throttle smoothly to 30" Hg and the propeller control to 2000 RPM. Use caution and be sure you have the propeller control in the crook of your finger, and not the mixture con-

trol knob. It doesn't take much movement of the propeller control to lower the RPM from take-off RPM to 2000 RPM, so be careful not to over-control when moving this control.

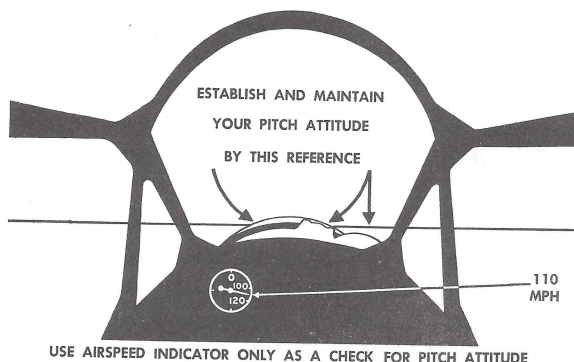
Continue to hold the original take-off pitch attitude until the airspeed reaches 110 MPH, then establish the correct climbing attitude. This attitude is just a slight amount higher than the take-off attitude, so only a small pitch change will be required to maintain the desired climbing attitude and airspeed.

When making these slight pitch changes, do not look at the airspeed indicator. Watch the attitude of the aircraft in relation to the horizon. Make the slight pitch change that is desired, and hold this new attitude constant. Remember, there is an inertia problem, and the aircraft will not accelerate or decelerate immediately with the pitch change and the new



"Crabbing" into the Wind after Becoming Air-Borne





### Nose Attitude in Climb

attitude. You must wait momentarily until the inertia of the aircraft is overcome and the speed has settled to normal for the new pitch attitude, then you may look at the airspeed indicator as a check to see if the attitude is the correct one. If you have over or under corrected, the airspeed indicator will show it by reading high or low as the case may be. Then you must make another small pitch change and hold it momentarily again. When you have attained the correct pitch attitude, continue to hold it constant by watching the horizon and outside visual references. Use the airspeed indicator only as a check to determine if the attitude you are holding is the correct one.

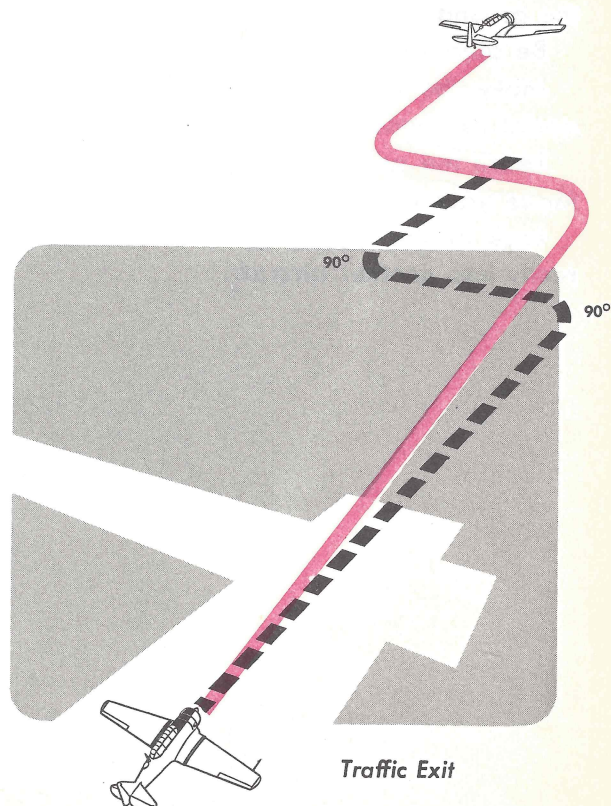
Disregarding the position of the landing gear and flaps, remember that *for one pitch attitude and one power setting, there can only be one airspeed*. Learn to fly the aircraft by establishing correct and constant attitudes, and the airspeeds will take care of themselves.

When the correct climbing attitude has been established by control pressures, use the trim tabs to relieve all pressures from the controls. This will make it much easier to hold a constant attitude.

Now look back toward the runway to make certain that you are not drifting. If you see that you are drifting, make a slight coordinated turn with stick and rudder back toward your original course. Roll out of this turn with the nose pointed slightly to the opposite side

of the line of take-off. You should now be maintaining a straight path over the ground with the nose of the aircraft turned slightly from the direction of the take-off runway. This is known as "crabbing."

If an aircraft has made a take-off ahead of you, anticipate the possibility of propwash, especially if the wind condition is calm or straight down the runway. Your first experience with the effects of propwash may come as a complete surprise. If corrective action is slow, an undesirable flight condition may result if you are close to the ground. Although sudden deviation from the original flight attitude may occur, do not become unduly alarmed. Merely use firm control pressures to control the aircraft and start a turn in either direction. Fly out of the propwash and align the aircraft parallel to the original flight path. If a cross-wind is present, make the turn up-wind, since the propwash will be blown down-wind or away from your aircraft.



### TRAFFIC EXIT

Clear the area all around, above, and below you. When you reach the minimum altitude for the traffic exit, look all around and start a medium-banked turn (approximately 40° bank) in the direction of traffic. Maintain a climbing pitch attitude. You should know the proper direction to turn for each runway or take-off area. You will find this information concerning your field published in "Local Flying Regulations." Maintain a climbing airspeed and attitude, noticing reference points on the wing and checking these points with relation

to the horizon. This turn is a 90° clearing turn with traffic. Anticipate drift by rolling out of the turn slightly before you reach 90°. Roll immediately into a 90° climbing turn in the opposite direction, again utilizing a 40° bank, and a climbing pitch attitude. Do not hesitate between turns. This is your exit from the traffic pattern. These two turns should describe exactly 90° changes in direction *over the ground*, even though strong winds may necessitate a crab to maintain the desired ground track and cause the actual change of direction of the aircraft to be less than 90°.

### Things To Remember

Always set your trim tabs properly for take-off. If they are not properly set, you will have to use much more pressure to control the aircraft.

Be sure that you are using the proper runway or landing area for take-off.

Listen to the tower and observe traffic before you line up for take-off.

Open the throttle slowly and smoothly. Rough, abrupt throttle usage will magnify the effect of torque.

Let the aircraft fly itself off the ground. If you pull it off too soon, it may fly back onto the ground.

Be alert for propwash from other aircraft during the take-off.

Make the proper corrections for torque and drift. Be sure that your ground track is an aerial continuation of the straight line of the runway.

Learn the proper attitude for a normal climb and use it on your climb out from take-off. Make your turns out of traffic at the proper place and altitude.

Look around before you turn. Never make any turn before you look. You might turn directly into another aircraft.