

traffic patterns and landings



chapter 7

part II Landings and Ground Control

In this chapter you will study the aerodynamic factors that affect an aircraft during a landing and the flying technique you must use to properly control these factors. Although the aspects of only the normal power-off, three-point landing will be explained, the aerodynamic principles covered will be applicable to any type of landing.

In order that you may better understand the factors that might affect your judgment and pilot technique, the landing will be divided into three phases — the round-out, the touch-down, and the after-landing roll. They are defined as follows:

The round-out is that part of the final approach that begins when the final approach glide is broken and completed when the touch-down has been effected. It is executed by smoothly changing the flight attitude from a glide to the intended landing attitude.

The touch-down is the point at which the wheels of the aircraft actually contact the landing surface.

The after-landing roll is the forward roll of the aircraft on the landing surface after a touch-down has been executed. It continues until the forward speed has slowed to normal taxi speed or until the aircraft is brought to a stop.

NORMAL LANDING

The normal landing as used in primary pilot training is a three-point attitude landing, since the T-6 was aerodynamically designed and stressed for the three-point landing. A normal landing could be explained as an ideal landing made without wind factors present and defined as "a condition in which an aircraft settles onto a landing surface in a three-point attitude from a "mushing" or semi-stalled condition."

During any landing, the longitudinal axis of the aircraft must be aligned with the landing runway throughout the approach, touch-down, and after-landing roll. The actual touch-down of an ideal normal landing is effected when all three wheels contact the runway at the same time. As the aircraft settles onto the landing surface, it is not fully stalled because the aircraft still has flying speed and the controls are effective. The settling condition is a result of a decrease in lift coupled with decreased thrust.

The Round-out

On the final approach and round-out as you descend toward the runway, you will have the impression that you are sitting still and the ground is moving upward. When you appear to be *approximately 75 feet* above the ground,

begin applying smooth back pressure to the stick to slowly increase your pitch attitude as you continue to descend. This will cause the nose of the aircraft to begin rising, thus gradually breaking the final-approach glide and initiating the round-out. (See illustration below)

The height at which the final-approach glide should be broken has been designated as approximately 75 feet above the ground. This distance does not by any means apply to all landing conditions. Higher gliding speeds and different aircraft loadings will cause it to be varied. You must learn to approximate the height of the buildings, trees, etc., in order to use them as visual references in determining the proper height to initiate the round-out. Your instructor will show you, by the use of these references, the height at which a 90-MPH, power-off glide should be broken. Use this height as a basis and initiate the round-out as conditions warrant.

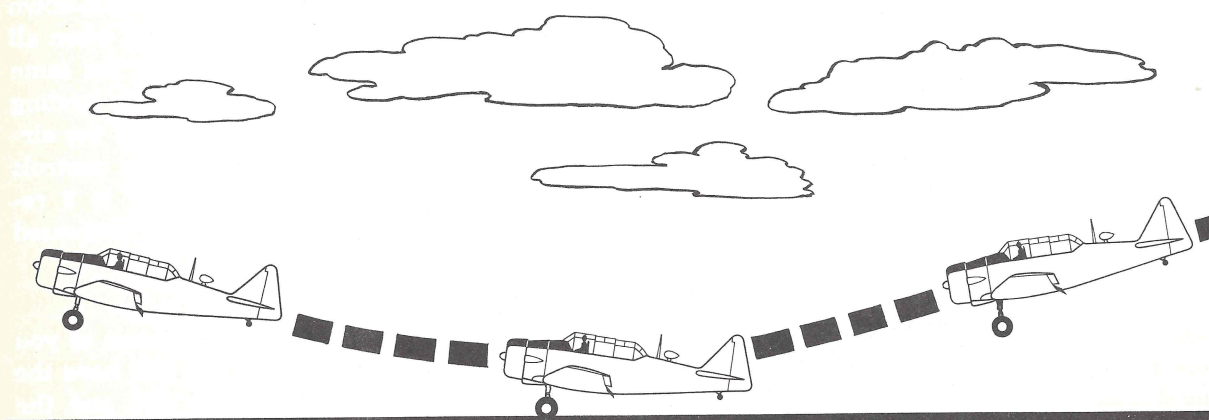
When the nose of the aircraft is raised in a round-out, the lift is momentarily increased; consequently, the rate of descent is decreased. (The ground does not appear to be coming up as fast.) However, since power is not used to increase the thrust during a landing, the airspeed will be constantly decreasing. This in turn will cause the lift to decrease, and the angle of the relative wind to increase. In effect, when you execute a landing, you are decreasing the airspeed to touch-down speed and

at the same time increasing the lift to let the aircraft down gently onto the runway. The round-out should be executed so that a three-point attitude and landing airspeed are attained just above the runway surface. From this height the aircraft will gently mush onto the runway.

On the final approach, plan your round-out so that the apparent rate of movement of the ground upward will gradually be decreased until you attain a three-point attitude just above the runway surface. You should do this by gradually increasing the pitch attitude throughout the round-out.

Since it is not always possible to execute a perfect round-out and landing, you must know how to make corrections safely and properly. Several of the common difficulties that you may encounter through misjudgment will be outlined and explained.

Judging the speed of the round-out: The speed at which the round-out is executed depends on the conditions of flight, the height of the aircraft above the ground, and the rate the aircraft is descending. A high round-out must be executed more slowly than one from a lower height so that the altitude will be dissipated. Execute your round-outs at a speed proportionate to the apparent rate of movement of the ground upward. When the ground appears to be coming up rapidly, raise the nose



Ballooning Results From Rounding-Out Too Rapidly

of the aircraft rapidly. When the ground appears to be coming up very slowly, increase the pitch attitude at a slow rate.

Ballooning: If you misjudge the apparent upward movement of the ground and think it is coming up faster than it actually is, you may increase the pitch attitude too rapidly and cause the aircraft not only to stop descending but actually to start climbing. This climbing during the round-out is known as "ballooning." Ballooning presents a dangerous situation because your height above the ground is being increased and your aircraft may be approaching a stall condition. Anytime that you balloon excessively, apply power smoothly and execute a go-around. It is possible to apply power and ease the aircraft to the ground, but this is a dangerous practice because it requires such an extremely high degree of judgment and proficiency. Don't take a chance; *go around* immediately.

Sometimes when the ground stops coming up toward you, your round-out has been too rapid, and you will be too high above the runway. To compensate for this you can maintain a constant pitch attitude until the aircraft again starts descending and then continue with the round-out. However this technique should be used only when you have adequate flying speed. If, however, you have reached a three-point attitude and are still well above the ground, don't wait for the aircraft to start descending again. Execute a go-around and plan another round-out after your new approach. Remember that when a three-point attitude is attained, the aircraft is rapidly approaching a stall because the airspeed is decreasing and the critical angle of attack is being approached even though you are no longer increasing the pitch attitude.

In your study of descents you learned that as the nose was lowered to a descending attitude, the lift of the aircraft was decreased momentarily as the pitch changed. This is also true during a round-out. If you lower the nose of the aircraft when fairly close to the runway to increase your rate of descent, your

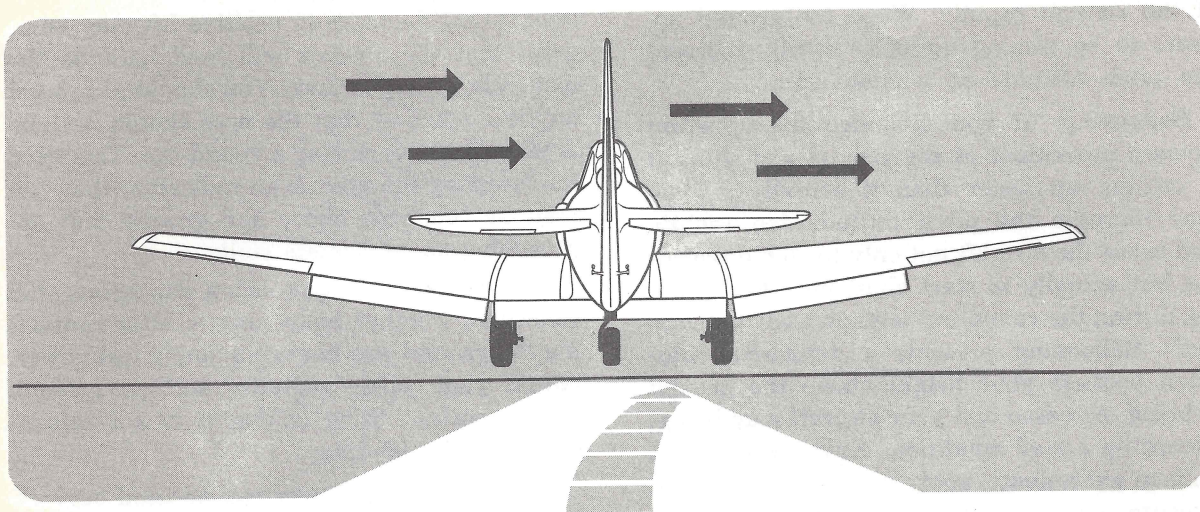
momentary decrease in positive lift may be so great that the aircraft will land hard on the main wheels and bounce. You should go around anytime you feel that the nose should be lowered excessively during a round-out. This need for lowering the nose is an indication that you may be too high above the ground and approaching an immediate stall.

At any time you approach a dangerous stall condition, whether ballooning or after contacting the ground and bouncing, apply full power, adjust your pitch attitude, and go around. The important thing is that *it is not safe to continue the landing.*

Use of throttle: Power can be used very effectively during the round-out to compensate for errors in your judgment. Since it increases both thrust and lift, power can be used to decrease your rate of descent as well as prevent a stall from occurring. Any time that the control pressures feel "mushy" and it is apparent that you are losing control of the aircraft, apply power to execute a go-around or to cushion the landing. When you have reached a three-point attitude and are slightly high, hold the landing attitude and apply sufficient power to ease the aircraft to the ground. After the landing has been effected, close the throttle so that the additional thrust and lift will be removed and the aircraft will stay on the ground.

Use of flaps: The attitude of the nose in a 90-MPH, full-flap glide is considerably lower than a 90-MPH, no-flap glide. So during a round-out to a three-point landing attitude the nose must travel through a greater angle of change when full flaps are used. Since the round-out is initiated at essentially the same height above the ground, regardless of the degree of flaps used, you must increase the pitch attitude a little faster when full flaps are used. But whether or not this is apparent to you, the round-out should still be executed at a speed proportionate to the apparent movement of the ground upward.

Rounding out too late and too fast: If you wait too late to execute the round-out and



Effect of Rigging During Landing

pull the stick back extremely fast to prevent the aircraft from touching down, you can cause a high-speed (excessive back-stick) stall. The effect centrifugal force has on the wing loading of an aircraft during rapid changes in pitch attitude has been explained previously in the chapter on stalls.

Although this initially is not a dangerous situation, it will cause the aircraft to land extremely hard on the main landing gear and bounce high into the air. As the aircraft bounces into the air, the tail will be forced down very rapidly by the back pressure that you are holding on the stick, and by inertia acting downward on the tail section. Depending on the magnitude of the bounce this may cause an excessive nose-high attitude well above the ground, a dangerous situation would then be established, and a go-around must be executed immediately.

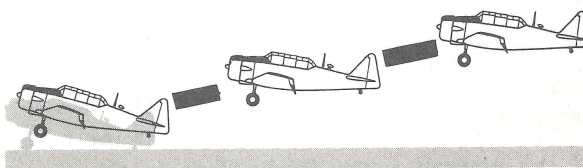
The Touch-down

The touch-down is the settling of the aircraft gently onto the runway from a three-point landing attitude. As it settles, the landing attitude must be maintained by whatever back-stick pressure is necessary. During your landing practice you will find that it is unnecessary to use full back-stick pressure to maintain this attitude. After the landing has

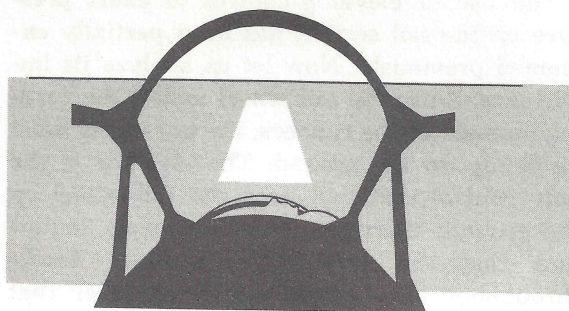
been executed, however, and when all three wheels are on the ground, the stick should be brought smoothly to the full rear position and held firmly back throughout the after-landing roll. This is done to force the tail wheel solidly on the ground so that maximum steerability may be obtained.

In the event power has been maintained during the round-out to decrease the rate of descent or prevent a stall, the throttle should be *completely* closed after the touch-down has been effected and the stick brought smoothly to the full-rear position. Make certain that all power is shut off immediately after the touch-down so that the aircraft will stay firmly on the ground.

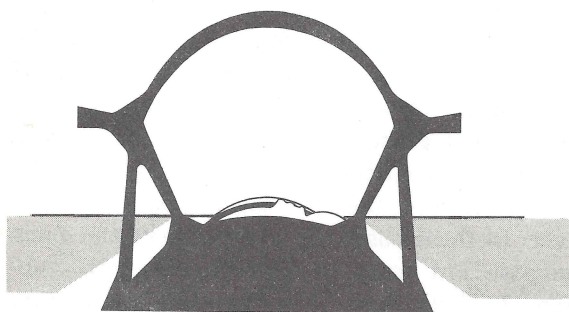
Since the normal landing is being explained as an ideal situation when in a calm wind condition, the effect of rigging will be explained. Rigging will affect the aircraft during the



Settling Into a 3-Point Landing



View During Normal Approach



View During Landing Roll

round-out and landing just as it does in other conditions of flight. The vertical stabilizer, being fixed at an angle of one degree and forty-five minutes to the left of the longitudinal axis of the aircraft, will cause the aircraft to tend to yaw to the right when there is no torque present.

Assuming there is a calm wind condition, the only wind acting on the aircraft is the relative wind caused by the forward movement of the aircraft. This means that the aircraft will yaw or turn to the right during the round-out and landing unless a slight amount of left rudder pressure is used to keep the nose straight. This also applies when the wind is blowing straight down the runway. Although this rigging effect is also present during cross-wind landings, it may not be apparent because rudder pressure is already being used to compensate for other more prominent factors.

The After-landing Roll

The after-landing roll is a very important part of the landing, because *directional control must be maintained* throughout the roll. The after-landing roll is not completed until normal taxi speed is reached or until the aircraft is brought to a stop.

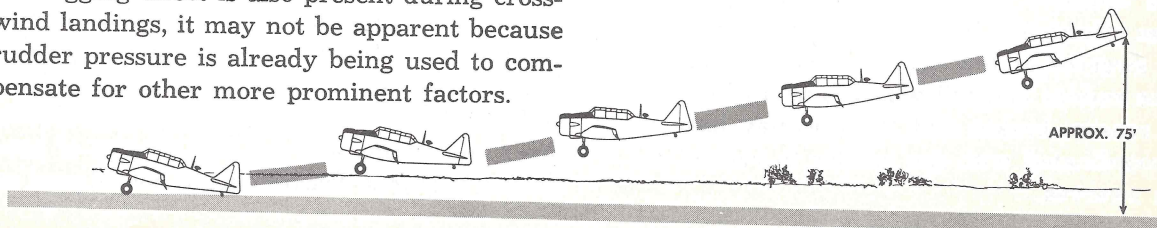
To properly execute this part of a landing, you must understand what factors may influence the maneuverability of the aircraft after the landing has been made so that you may exercise sound judgment in applying corrections. Some of these factors are a high center of gravity, strong cross-winds and/or gusty winds, swerves (yaw and/or roll), and a low oleo strut.

The T-6 is a well-constructed and stable aircraft. Because of its fairly high center of gravity in relation to the distance between the main landing gear, however, it may tend to swerve and/or tip during the after-landing roll unless firm, accurate control is maintained.

Strong cross-winds or gusty winds may cause one wing to be lifted to such an extent that the other wing may strike the ground. Special precautions will have to be maintained any time the wind is a cross-wind and/or gusty. (These will be explained later in this chapter.)

Any time there is a change in direction, centrifugal force will cause the center of gravity of the aircraft to be moved outward and away from the direction of the turn. If the turn is severe, centrifugal force may move the center of gravity far enough to cause the outside wing to strike the ground. For this reason, swerves should be avoided whenever possible.

While considering these dominant factors affecting the after-landing roll, let us analyze what controls are available to counteract them and what effect they have on the aircraft.



Which control should be used primarily for directional control and which should be used primarily for keeping the wings level?

There are four control measures, all regulated from the cockpit, that can be used to control the aircraft on the ground. They are rudders, brakes, ailerons, and throttle. The elevator may be considered as a fifth means of controlling the aircraft since it influences the use of the other four. Normally, use of elevators in the landing roll consists of holding the stick firmly all the way back to increase the loading of the tail section. This keeps the center of gravity to the rear and permits more effective reactions from the steerable tail wheel and brake usage.

Rudder: The rudder serves the same purpose on the ground as it does in the air; it yaws the aircraft. On the ground, however, this yaw is transformed into directional control: that is, the rudder may be used to initiate a turn or to stop a turn. The effectiveness of the rudder depends on the speed of the aircraft. Although the speed of the aircraft is also a factor, the steerability of the tail wheel depends on the amount of pressure exerted on the tail section through the use of the elevators.

Immediately after touch-down, when the speed is high, rudder usage is very effective because the relative wind exerts pressure on the exposed side of the rudder surface and causes an immediate reaction. As the speed decreases, the pressures exerted by the relative wind likewise decrease, and the rudder becomes less and less effective for directional control.

The tail wheel is directly related to rudder usage and assists the turning moment caused by the rudders. As the rudder surfaces become less effective, the tail wheel becomes more effective for directional control but is not as effective as was the rudder. During violent swerves at low speeds, the effectiveness of the rudder and tail wheel is negligible. For this reason, brakes and throttle may have to be coordinated with the rudder to control severe swerves.

The use of elevator control to exert pressure on the tail section has been partially explained previously. Now let us analyze its importance. Since the tail wheel assists the turning moment of the rudders, the tail wheel must be firmly on the ground. The elevator is the only control that will keep the tail wheel on the ground; therefore, it is extremely important that the stick be held back firmly throughout the landing roll. Remember that you must hold the stick back with positive pressure or your tail wheel will be ineffective.

Brakes: The brakes of an aircraft serve the same purpose as the brakes of an automobile, that is, to reduce its speed on the ground. If the driver of an automobile slams on the brakes, his passenger is likely to be thrown into the windshield; likewise, if a pilot slams on his brakes, the aircraft is likely to nose over. In these cases the brakes serve the same purpose but cause a slightly different reaction. In both cases the forward momentum acts along a line of least resistance. In the first instance, it acts on the passenger and in the second case, it acts on the high center of gravity of the aircraft.

Why was the reacting force so great or why was the nose likely to be pulled down? The best answer would be that the braking force was abrupt. In other words, forward momentum will react at a rate in proportion to the braking action or pressure applied on the brakes, in short, to nose an aircraft over you must slam on the brakes very abruptly. Any time you use the brakes on an aircraft, apply brake pressure smoothly and at a constant rate. You can, by constantly increasing the brake pressure, bring the aircraft to a full stop without any tendency of a nose-over, provided the *stick is held back firmly and the brake pressure is applied smoothly*.

During any ground-roll, you can change your aircraft's direction by applying pressure on a single brake or uneven pressures on both brakes. Because of excessive wear on the brake shoes and drums and the high degree of proficiency required, brakes should not be used as

a normal means of directional control; brakes should be used to correct for turns or swerves when rudders are ineffective. You must exercise caution when applying corrective brake action because it is very easy to over-control. Your instructor will allow you to practice using the brake for directional control during fast taxi stages.

To use the brakes properly, slide the feet up from the rudder bar to the brake pedal. Do this whenever you deem the use of brakes necessary.

If rudder pressure is being held at the time the brakes are needed, be sure you do not release this rudder pressure as you slide your feet up to obtain braking action.

The preceding paragraphs on rudder control explained the loss of effectiveness of rudders during the latter part of the landing roll. You will recall that we explained the ineffectiveness of the rudders during swerves at low speeds. But, by using the brakes, you have a control that can be very effective after your rudders have lost most of their effectiveness. Use the brakes whenever they are needed to maintain directional control.

Ailerons: The ailerons serve the same purpose on the ground as they do in the air — to change the lift and drag components of the wings. When should they be used during the after-landing roll? How should they be used when there is no wind or when the wind is straight down the runway?

In answer to the first question, they should be used to maintain the wing-level attitude or in anticipation of a cross-wind, provided their use does not change your descent attitude. They should be used to level the wings just as they were used in straight and level flight.

The answer to the second question is that they probably will not be needed unless a wing starts down.

A third question should also be considered at this point. When will there be a difference in the lift components of the wings and, if there is a difference, why? Any time there is a cross-wind, there will be a difference in the

lift components because the up-wind wing will receive full effect of the wind, whereas the down-wind wing will be blanketed out to some extent by the fuselage of the aircraft. The more the cross-wind, the greater the difference in the lift components. For this reason, the aileron control will necessarily have to be held into the wind to a degree that will compensate for the velocity and degree of cross-wind. During sharp, gusty cross-winds, it may be necessary to use the aileron control somewhat abruptly. In this respect it would probably be wise to use throttle with the aileron as an additional precaution. Aileron technique will be explained further in cross-wind landings.

During the after-landing roll, if a wing starts down, use the opposite aileron to raise it and, if necessary, use throttle to increase its effectiveness. Note that as the forward speed of the aircraft dissipates, the ailerons become less effective. This leads to consideration of the fourth control that can be used to maintain directional control.

Throttle: Throttle increases both the thrust and lift of the aircraft by increasing the relative wind over the wings and slipstream over the tail surfaces. This, of course, causes all of the surfaces to be more sensitive and effective. During turns or swerves, adding throttle will pull the aircraft forward and resist the turning moment of the aircraft; however, it will also increase the torque effect. When large amounts of throttle are used, torque effects must be anticipated and corrected. As a safety rule, remember, *if used in time, throttle will get you out of almost any difficulty.*

Now that you have analyzed the controls and their function during the after-landing roll, what is the sequence of usage for maintaining directional control and keeping the wings level? *There is no established sequence; use any one or any combination of the controls.* This should be understandable, because there are so many variables which can effect a landing that a mechanical sequence is im-

practical. Remember, *there is no substitute for good judgment.*

1. To maintain directional control use:

Rudder

Brake

Throttle

2. To keep the wings level use:

Directional control

Aileron into the high wing

Throttle

During the landing roll, maintain directional control through varying degrees of rudder, brake, and/or throttle. Whether they are used in any sequence, or all simultaneously, depends on the nature of the landing. It is important, however, that directional control be maintained throughout the roll, even if you run off the runway. If the aircraft swerves at an angle to the runway, do not try to realign it immediately. Hold it straight ahead until you are absolutely sure that you have full positive control; then very slowly realign it with the runway. A large majority of accidents occur because the pilot over-controlled while realigning the aircraft. Remember that a turn creates centrifugal force which may cause one wing to go down, even though aileron is being used to pick it up. Keep the wings level by maintaining directional control and by using the aileron and/or throttle. It is absolutely impera-

tive that the stick be kept in the full back position unless a go-around is anticipated.

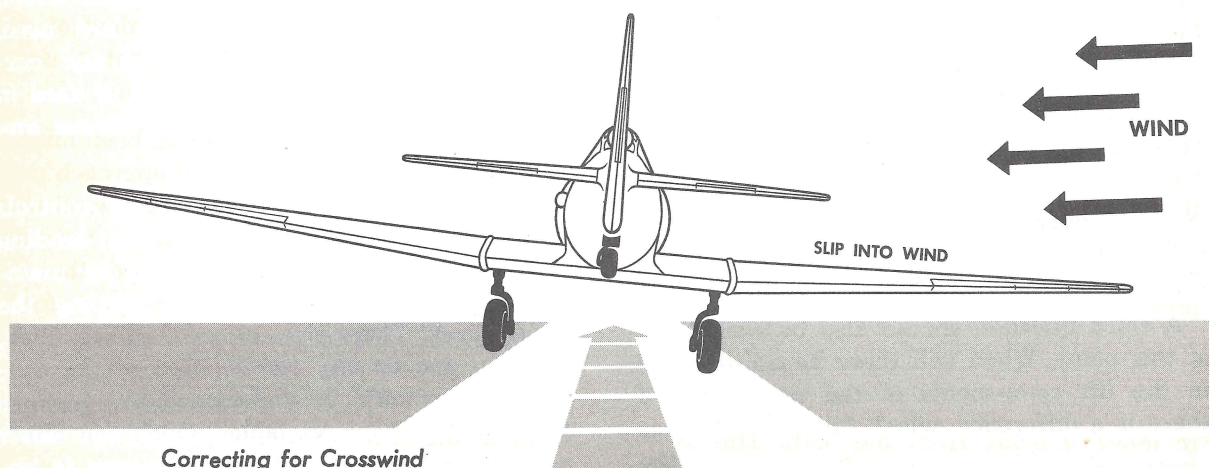
CROSS-WIND LANDING

Up to this point you have been studying the aspects of a normal landing with a normal approach, round-out, touch-down, and after-landing roll. Although they were presented as ideal situations, it is improbable that you will encounter very many ideal landing conditions with the wind calm or blowing straight down the runway. Many of your landings will be executed in cross-winds of various degrees and velocities.

For this reason it is necessary that you have a thorough understanding of the techniques employed in the execution of cross-wind approaches and landings. For the purpose of explanation, the cross-wind landing will be broken into integral parts — approach, round-out, touch-down, and after-landing roll — and explained separately; however, they must be thought of as one continuous landing maneuver.

The Cross-wind Approach

Although there are many types and kinds of approaches, (some of which will be explained in the accuracy landing stages later in this manual) the cross-wind approach will be the most important and probably the most frequently used. Although there are many ways of executing a cross-wind approach, only one is



utilized in the primary pilot training program. This is the wing-low method.

It was selected after considerable research as the safest for all pilots, regardless of the type aircraft being flown. The merits of the wing-low method cannot be over-emphasized. It will compensate for wind from any direction, permit you to keep the longitudinal axis aligned with the runway throughout the entire landing and after-landing roll, allow you to utilize the same visual references for the round-out since it is very similar to the normal round-out, and provide an automatic cross-wind correction during the round-out, touch-down, and landing roll.

After turning onto the final approach, establish the proper drift correction by lowering the up-wind wing with aileron. The degree that the wing is lowered is governed by the amount of drift that is present. If there is a strong cross-wind, the wing will have to be lowered farther than if a light cross-wind were encountered. Apply whatever rudder pressure necessary to keep the longitudinal axis of the aircraft properly aligned with the part of the runway on which you intend to land.

From your study of turns, you will remember that when you roll into a turn with aileron alone, the aircraft will begin to slip in the direction of the turn or toward the low wing. After the slip has been established the nose will begin to turn in that direction unless rudder is used to keep it from turning. This is exactly what happens when you lower the wing for drift correction on a cross-wind approach.

You will also recall, from your study of drift, that the wind will cause an aircraft to move with it and at the same speed, unless a drift correction is established. So when you are on the final approach and a cross-wind is present, you must apply a drift correction or the aircraft will drift away from the desired approach path.

In order to stay on your desired approach path, you must slip the aircraft back into the wind at the same rate that the wind is trying to move it away from the path. This is ac-

complished by lowering a wing into the wind, and it must be maintained as long as the cross-wind is apparent. If the effect of the cross-wind is reduced, this cross-wind correction must also be reduced or the aircraft will begin slipping away from its flight path and into the wind.

On the final approach and throughout the landing, keep the longitudinal axis aligned with the landing runway regardless of the amount of cross-wind correction used. Use whatever rudder pressure that may be necessary to keep the nose traveling straight down an imaginary line that runs the entire length of the side of the runway on which you intend to land. The idea behind the wing-low drift correction technique is to counteract the drift and keep the longitudinal axis aligned with the runway.

The procedure just outlined differs only slightly from a normal approach. The pitch attitude, airspeed, and round-out are the same as if no wind were encountered. This wing-down (cross-control) condition is maintained throughout the round-out and landing, thus providing an automatic correction to overcome the tendency of the up-wind wing to be lifted and the tendency of the aircraft to weather-vane.

The wind condition in which you will normally fly will require relatively small cross-wind corrections and should give no cause for apprehension.

To summarize the wing-low method of correction for a cross-wind, your thought sequence should generally follow this pattern:

"I can see that my aircraft is beginning to drift to one side of my intended approach path. To prevent this, I will lower the up-wind wing until the drift is cancelled. The nose of my aircraft is beginning to turn toward the low wing; thus, I must apply rudder pressure to keep it straight and the longitudinal axis aligned with the runway. Now as I continue down the approach, I must vary this correction as the wind changes."

The Cross-Wind Round-Out

When the point of round-out is reached, begin breaking the glide smoothly just as if no wind were encountered. Continue to maintain the cross-wind correction — up-wind wing down and rudder to keep the longitudinal axis aligned with the runway. The pitch attitude should increase smoothly to a landing attitude at a rate proportional to the apparent upward movement of the ground.

Since the airspeed is dissipating slowly as the round-out progresses, the effectiveness of both the ailerons and rudder are reduced. These are the controls that are being used to correct for the cross-wind. Since these controls are losing some of their effectiveness, you must increase the movement of these controls and expose more of their surface to the relative wind in order to maintain the same wind-drift correction. In short, as the round-out is executed, progressively more up-wind aileron and opposite rudder must be used to prevent the aircraft from drifting. Not only must you increase the control pressures, but you must actually lower the wing further as the speed decreases. The lower the speed of the aircraft, the more relative effect the cross-wind has in causing it to drift in relation to the ground.

Do not level the wings during the round-out or touch-down as long as the cross-wind is affecting the aircraft. You must keep the wing down throughout the round-out, and while the touch-down is made.

If you level the wings, the aircraft will begin drifting and will touch-down in a crab and/or drift. This will cause the center of gravity to be thrown in the same direction of the drift, thus giving the aircraft a tipping or rolling effect in that direction. It will also cause the aircraft to have a swerving tendency into the wind. The aircraft may even start to ricochet off the runway at the same angle at which it strikes the runway.

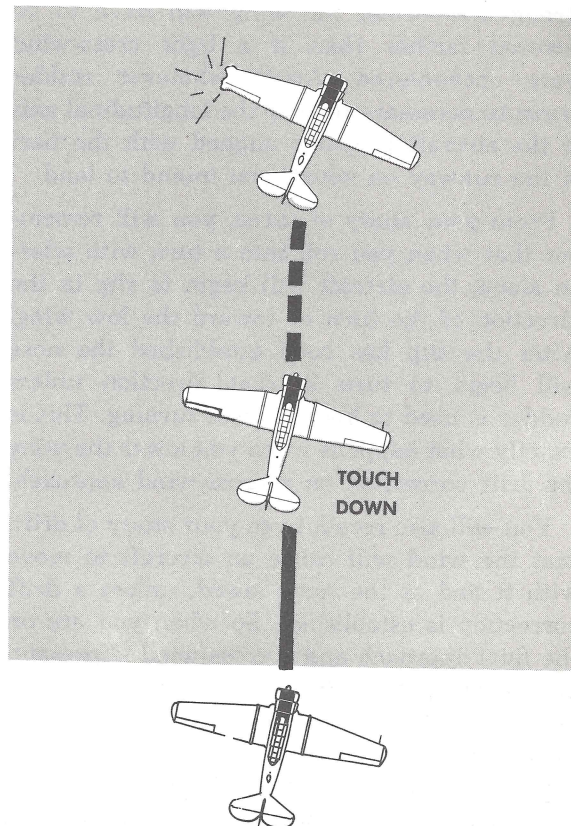
The Cross-wind Touch-down

As the aircraft settles onto the runway in a three-point attitude, actual touch-down will be made on only two wheels — one of the

main wheels and the tail wheel. As the forward momentum decreases, the weight of the aircraft will cause the third wheel to settle onto the runway. Thereafter, the landing is normal except that an aileron will be held into the wind.

Since a certain amount of down-wind rudder is being held throughout the round-out and touch-down, the tail wheel will be turned very slightly in the direction that would cause a slight swerve away from the wind. The amount the tail wheel is turned is negligible, but even so it gives a desired effect; that is, it tends to counteract any tendency of the aircraft to serve into the wind.

During gusty or high wind conditions, extreme caution should be exercised to make certain that the aircraft is not drifting and/or crabbing as the landing is executed. Go around

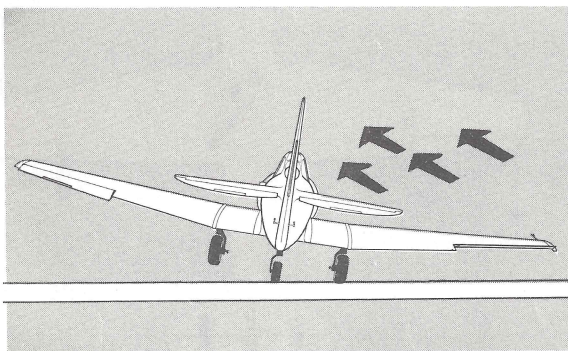


Touching-down in a Crab Causes Initial Swerve into Wind

if necessary but *do not land while drifting or crabbing.*

Touch-down in a Crab and/or Drifting

A "crab" or drift is a condition that occurs when a touch-down is executed while the longitudinal axis of the aircraft is *not* aligned with the landing track. Since the aircraft is actually traveling sideways in relation to its



*Normal Crosswind Touchdown
one Main Gear and Tail Wheel*

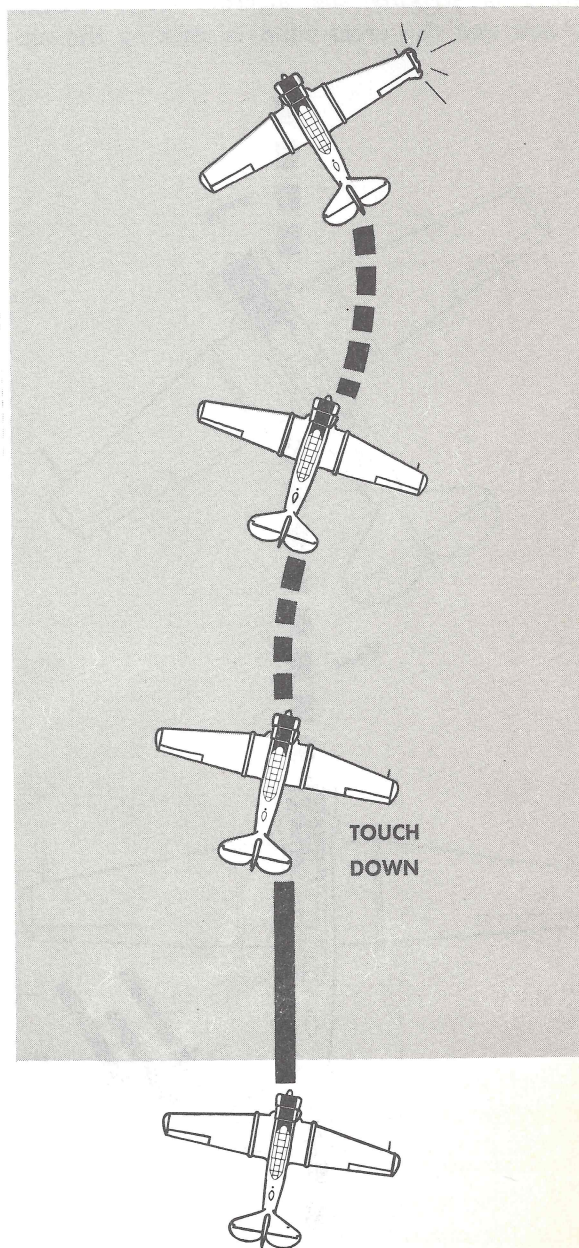
landing track, it will be given a tipping moment in the direction that the aircraft is traveling. Touching down in a crab or drift will also cause the aircraft to turn away from the intended landing path. This turn is called a "swerve." Anytime a swerve develops, centrifugal force will shift the center of gravity in the opposite direction and thus cause the outside wing to come down. It is dangerous to land in a crab or drift because control of the aircraft may be lost momentarily thus exposing you to other adverse landing factors.

The Cross-wind After-landing Roll

Before explaining the techniques employed to maintain directional control and to overcome the effect of a cross-wind on the after-landing roll, you must first understand the effect wind has on the aircraft during the roll.

When an aircraft is airborne and free from the ground, it is moving through a mass of air, and at the same time moving in the same direction and at the same velocity that the mass is moving. This is true, regardless of the

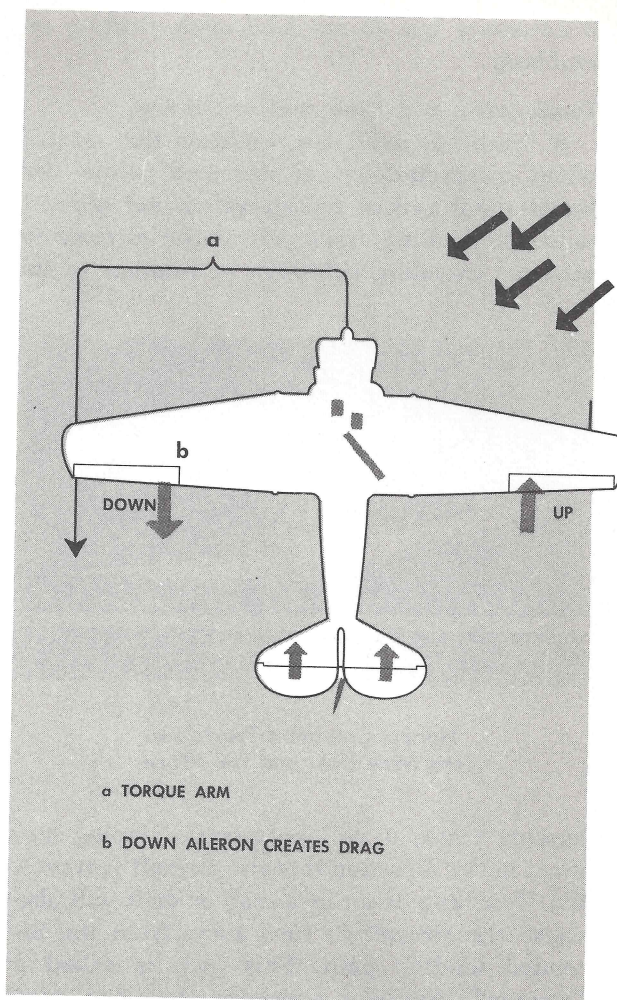
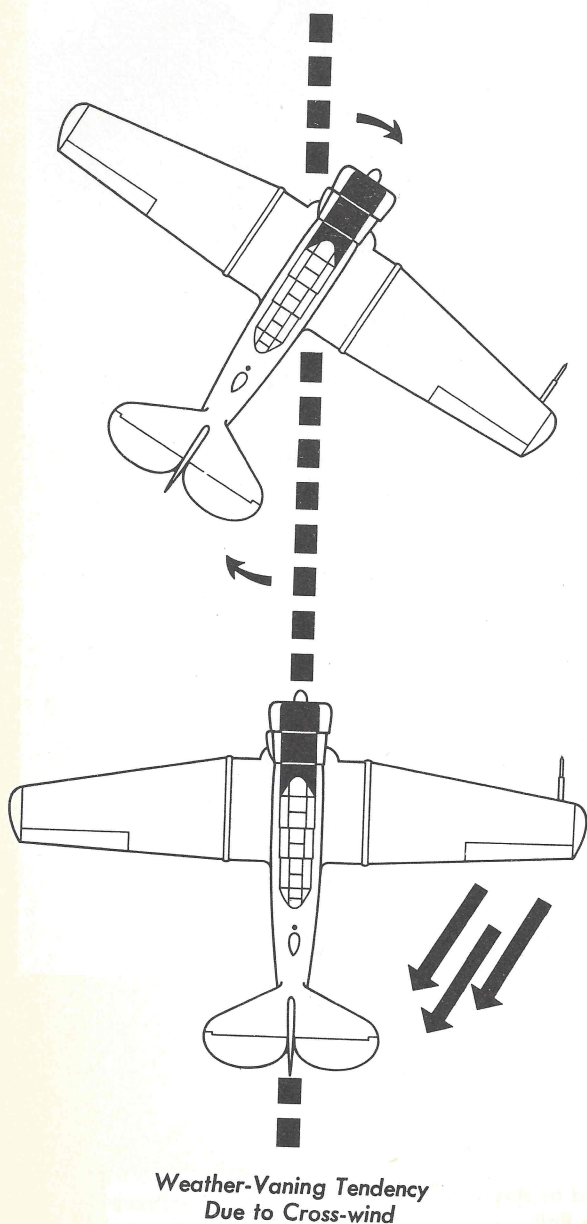
heading and velocity of the aircraft. Therefore, the only wind that is acting on the aircraft is the wind that is created by the aircraft's movement through the air. This is called the relative wind. It always strikes the aircraft from straight ahead during coordinated flight. Although the wing-low method of cor-



*Attempting to Re-align Aircraft With
Runway after Swerve Has Developed*

recting for drift during a landing results in a slight slip, for all practical purposes the relative wind may be considered as striking the aircraft from straight ahead.

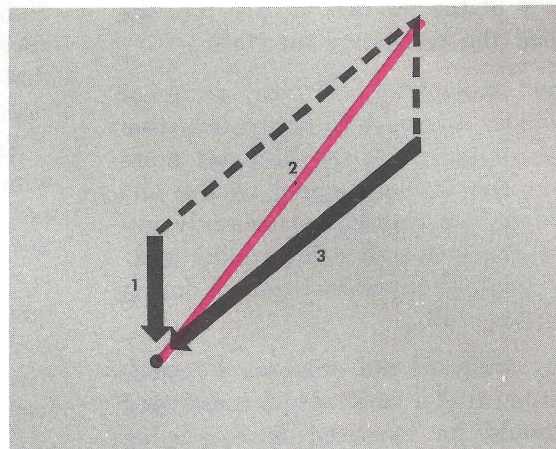
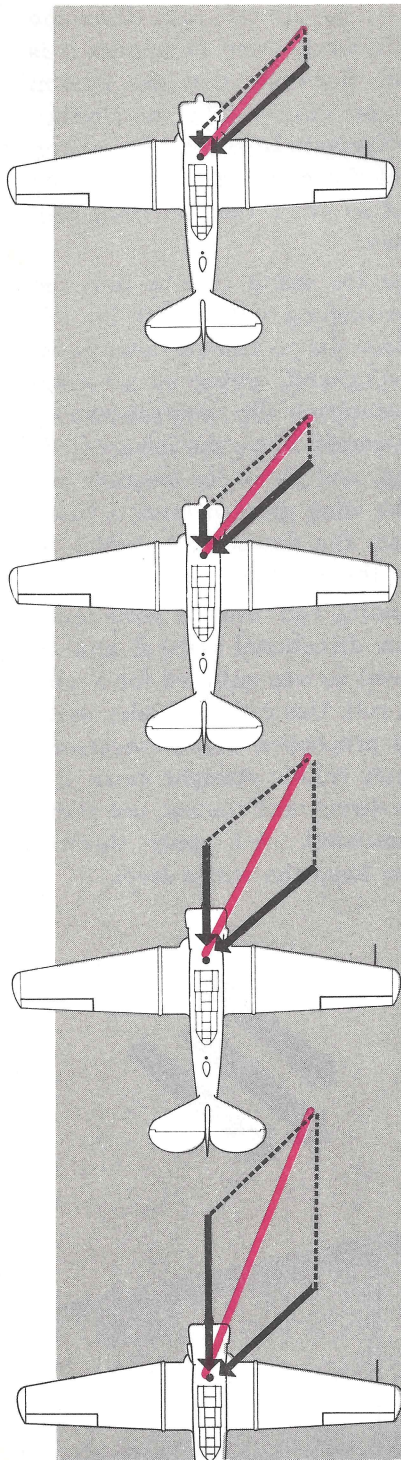
When an aircraft is on the ground, however, it is unable to move with the air mass. Therefore, the relative wind as well as the cross-wind is acting on the aircraft. The relative wind is striking the aircraft from straight ahead and the cross-wind is striking the air-



*Down-wind Aileron Greatly
Assists Rudder in Directional Control*

craft from one side. Somewhere between these two winds there evolves a resultant wind component. The angle that this resultant wind component strikes the aircraft depends on the velocities and directions of the two winds. As the aircraft slows down on the after-landing roll, the resultant wind moves more broadside or toward the cross-wind component, because the relative wind from ahead is gradually diminishing while the cross-wind is staying constant.

The construction of the T-6 aircraft is such that there is more side area behind the main landing gear than in front. Considering



1. RELATIVE WIND CAUSED BY FORWARD MOTION.
2. RESULTANT WIND ACTING UPON THE AIRCRAFT.
3. CROSS-WIND.

- 1 AIRCRAFT SLOWS DOWN
- 2 RELATIVE WIND COMPONENT DECREASES.
- 3 RESULTANT WIND MOVES MORE AND MORE TO SIDE.

Increasing Lateral Effect of Cross-wind as Aircraft Slows Down on After-Landing Roll

the main landing gear as the fulcrum point and the difference in the side area forward and aft of this point, the aircraft will act as a weather vane and try to nose into the wind. This tendency of the aircraft to turn into the wind is called the weather-vaning effect.

From the explanation of the resultant wind component, it is easy to understand that this weather-vaning tendency becomes more prominent as the forward speed of the aircraft dissipates. You should consequently understand the importance of using rudder and/or brake to maintain directional control during the after-landing roll.

During the study of the cross-wind round-out, you learned that a landing in a cross-wind condition should be executed with a wing down. You also learned that the aileron should be held into the wind even after the aircraft was on the ground in a three-point attitude to prevent the wind from lifting that wing. Of course, when all three wheels are on the ground, the wings will necessarily be level.

Now, if you consider the increasing angle of the resultant wind component, you should realize the importance of moving the aileron farth-

er into the wind as the aircraft rolls down the runway and the forward speed dissipates. It is equally important, however, that the aileron not be used to the extent that the desired flight attitude is changed. In short, use enough aileron to prevent the cross-wind from lifting that wing but not so much that the wing will start coming down.

Another reason for using aileron into the wind on the after-landing roll, is that the aileron control surface that is moved down is on the down-wind wing and, acting as a torque arm, helps to counteract the weather-vaning tendency of the aircraft. Since the lowered aileron creates drag, and since its location out near the tip of the wing gives it quite a turning force, it assists the down-wind rudder in compensating for the weather-vane effect.

On the after-landing roll, use the same technique to maintain directional control and to keep the wings level as was outlined for a normal after-landing roll. Use rudder, brake, and/or throttle in any proportion that is necessary to keep the aircraft rolling straight down the runway. Maintain directional control, use aileron into the cross-wind, and apply throttle when necessary to keep the wings level.

