

VII.F. Normal and Crosswind Approach and Landing

References: FAA-H-8083-3; POH/AFM

Objectives	The student should be able to perform a normal approach and landing as prescribed in PTS. The approach and landing should be performed satisfactorily with or without a crosswind, and with the necessary corrections based on the situation.
Key Elements	<ol style="list-style-type: none">1. Stabilized Approach2. Smooth, Controlled Roundout3. Hold the airplane inches above the ground before touching down4. Don't Side Load the Aircraft
Elements	<ol style="list-style-type: none">1. Determining Landing Performance and Limitations2. The Downwind Leg3. The Base Leg4. The Final Approach5. The Roundout6. The Touchdown7. The After Landing Roll8. The Crosswind Approach9. The Go Around10. Obstructions and Other Hazards to Consider11. Wind Shear and Wake Turbulence
Schedule	<ol style="list-style-type: none">1. Discuss Objectives2. Review material3. Development4. Conclusion
Equipment	<ol style="list-style-type: none">1. White board and markers2. References
IP's Actions	<ol style="list-style-type: none">1. Discuss lesson objectives2. Present Lecture3. Ask and Answer Questions4. Assign homework
SP's Actions	<ol style="list-style-type: none">1. Participate in discussion2. Take notes3. Ask and respond to questions
Completion Standards	The student can fly a coordinated, stabilized approach, transitioning into a smooth roundout and touchdown without side loading the airplane, with or without a crosswind.

Instructors Notes:

Introduction:

Attention

Interesting fact or attention grabbing story
The landing is the most difficult and most fun part of flying.

Overview

Review Objectives and Elements/Key ideas

What

A normal approach and landing involves the use of procedures for what is considered a normal situation; that is, when engine power is available, the wind is light or the final approach is made directly into the wind, the final approach path has no obstacles, and the landing surface is firm and of ample length to gradually bring the airplane to a stop.

Why

It's really a good skill to know when we decide we want to land the plane. Not only that, but, the factors involved and procedures used also have applications to the other-than-normal approaches and landings.

How:

1. Determining Landing Performance and Limitations

- A. Performance is determined by using the appropriate charts in Chap 5 of the POH
- B. Limitations are determined in Chap 2 of the POH
- C. **CE** - Improper use of landing performance data and limitations

2. The Downwind Leg

- A. Parallel to the runway of intended landing at 1,000' AGL
- B. Checklists
 - i. Complete the Before Landing Checklist at the midpoint on downwind
 - ii. **CE** - Failure to establish approach and landing configuration at appropriate time or in proper sequence
- C. Abeam the landing threshold
 - i. Begin the descent
 - a. Reduce power to 1500 RPM
 - b. Set takeoff Flaps
 - c. Airspeed - 75 knots
 - Maintain pattern altitude, allowing the airspeed to bleed to 75 knots, when approaching 75 knots, establish the pitch attitude to maintain 75 knots in the descent
- D. 45° from the runway threshold
 - i. At the 45° point begin the turn to base
 - a. Shallow to medium bank
 - ii. Usually a decent of approximately 200' will put you at the 45° point

3. The Base Leg

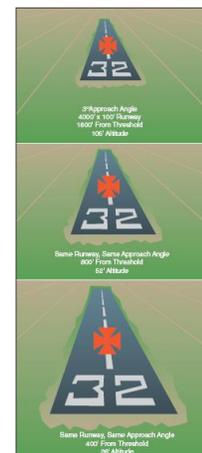
- A. Perpendicular to the approach end of the runway of intended landing; the leg prior to turning final
- B. Configuration
 - i. Airspeed - 70 knots
 - a. Adjust pitch and power as necessary to slow from 75 to 70 knots

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- C. Drift Correction
 - i. Maintain a ground track perpendicular to the runway
 - ii. There often will be a crosswind pushing the airplane away from the runway
 - a. This is because landing is done into the wind
- D. Position of the Base Leg
 - i. Wind
 - a. The stronger the wind, the closer the base leg should be to the runway
- E. The Turn to Final
 - i. Medium to shallow bank turn should align the airplane with the centerline of the runway
 - a. No more than 30° of bank
 - Stall speed increases rapidly above 30° of bank, this is very unsafe when slow and close to the ground
 - b. In the case a steep bank is necessary, a go around is recommended
 - A go around is highly preferred over a steep bank or crossed control situation
 - ii. Usually a loss of 200' as well on the base leg

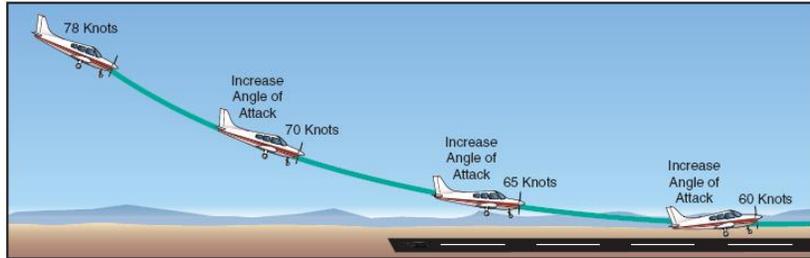
4. The Final Approach

- A. The longitudinal axis of the airplane is aligned with the center line of the runway and the final descent to the landing runway is made
- B. Configuration
 - i. Landing Flaps
 - ii. Airspeed - 65 knots
 - a. Adjust pitch and power to establish final approach speed (65 knots)
 - iii. Landing Checklist
- C. A Stabilized Approach
 - i. **CE** - Failure to establish and maintain a stabilized approach
 - a. A stabilized approach is a safe approach
 - b. An unstabilized approach increases the risk of excessive rates of descent or slow airspeed while close to the ground
 - c. Adjust Pitch for airspeed and Power for altitude to maintain speed and glide path
 - ii. The pilot establishes and maintains a constant angle glidepath towards a predetermined point on the landing runway with the airplane in a position where the minimum input of all controls will result in a safe landing
 - iii. Controlling Decent
 - a. Power and pitch as necessary to maintain a stabilized approach and glide slope
 - Region of Reverse Command
 - a. Below LD_{MAX}
 - b. Pitch for airspeed and power for altitude
 - b. A change in any of the variables requires a coordinated change in the other controllable variables
 - EX: Why do we never try to stretch the gliding distance with back pressure alone?
 - a. If the Pitch attitude is raised too high without increasing power this will cause the airplane to settle rapidly short of the desired spot
 - 1. The gliding distance is shortened if power is not increased simultaneously
 - Proper angle of decent should be maintained by coordinating pitch attitude changes and power changes simultaneously
 - a. If the approach is too high, lower the nose and reduce power



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- A. A slow, smooth transition from a normal approach attitude to a landing attitude, gradually rounding out the flight path to one that is parallel with, and within a few inches of the runway



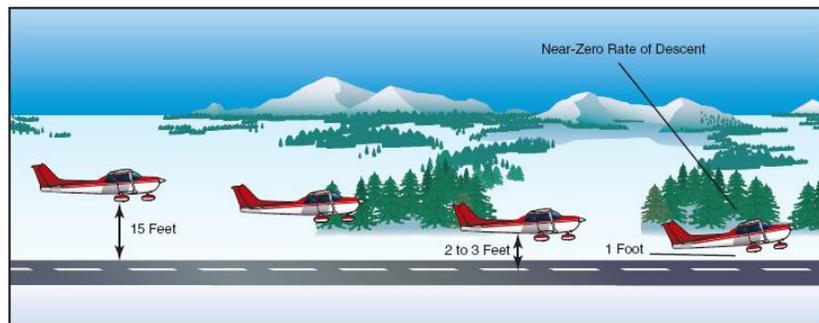
- B. Estimating Height and Movement
- Visual focus should not be fixed on any one side or to any one spot ahead
 - Focus should be changing slowly from a point just over the nose to the desired touchdown zone and back again
 - Maintain awareness of the distance from either side of the runway with peripheral vision
 - Speed and Vision
 - Speed blurs objects at close range
 - EX: Car at high speeds
 - The distance at which vision is focused should be proportionate to the speed of the airplane
 - As speed is reduced, the distance ahead of the airplane should be brought closer
 - Focusing too close will result in a blurred reference
 - Reactions will be too abrupt or too late
 - Tendencies in this situation include
 - Overcontrolling
 - Roundout High
 - Full stall, drop in landings
 - Focusing too far accuracy in judging the closeness of the ground is lost
 - Reactions will be too slow as there will not seem to be a necessity for action
 - Tendencies in this situation include
 - Flying into the ground nose first
 - If focus is gradually changed, being brought into focus as speed is reduced, the whole landing process will be smoothed out
- C. Starting the Roundout
- The roundout is started approximately 10 to 20' above the ground
 - Power is reduced to idle and back elevator is slowly applied gradually increasing the pitch attitude and angle of attack
 - Begins putting the nose of the airplane in the desired landing attitude
 - Angle of attack is increased at a rate that will allow the airplane to continue settling slowly as airspeed decreases
- D. Decreasing Lift, Increasing Pitch Attitude
- Increasing the angle of attack momentarily decreases the rate of descent
 - Because lift is momentarily increased
 - Since the power is idle, airspeed will decrease causing lift to decrease again
 - This must be controlled by raising the nose and further increasing the angle of attack
 - Airspeed is being decreased to touchdown speed while lift is being controlled so the airplane will settle gently onto the runway
- E. Roundout and Height Above the Ground

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- i. The rate at which the roundout is executed, depends on the height above the ground, rate of descent, and pitch angle
 - a. High Roundout
 - Executed more slowly to allow the airplane to descend to the ground while the proper landing attitude is being established
 - b. Low Roundout
 - Executed faster to allow the airplane obtain the proper landing attitude before striking the runway surface
 - c. Note: Once the roundout has been started, the elevator control should not be pushed forward
 - If necessary, relax back pressure or just hold it constant
- ii. **CE** - Inappropriate removal of hand from throttles
 - a. Always be prepared to apply immediate power or initiate a go around

6. The Touchdown

- A. The gentle settling of the airplane onto the landing surface at the minimum controllable airspeed with the airplane's longitudinal axis exactly parallel to its direction along the runway



- B. Ideal Landing
 - i. Hold the airplane's wheels a few inches off the ground as long as possible with the elevators
 - ii. In most cases, when the wheels are 2-3' off the ground, the airplane will be settling too fast for a gentle touchdown
 - a. The decent must be further retarded by further back-elevator pressure
- C. Longitudinal Axis
 - i. The longitudinal axis should be exactly parallel to the direction the airplane is moving along the runway
 - a. Failure to do this imposes severe side loads on the landing gear
 - b. Don't land while drifting
- D. Rudder Control
 - i. Less than normal is needed
 - a. With the engine idle, we have much less left turning tendencies
 - b. The airplane will fly almost coordinated itself
- E. After touchdown
 - i. Maintain back-elevator pressure
 - a. Maintains a positive angle of attack for aerodynamic braking
 - b. Hold the nosewheel off the ground until the airplane decelerates
 - ii. As momentum decreases, gradually relax the back-elevator pressure to allow the nosewheel down
- F. **CE** - Improper procedure during roundout and touchdown

7. The After Landing Roll

- A. The deceleration of the airplane to the normal taxi speed or when the airplane has been brought to a complete stop when clear of the taxi area

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B. Be Alert

- i. Accidents occur when pilots abandon vigilance and positive control

C. Directional Control on the Ground

- i. Be alert for directional control problems

- a. Due to ground friction on the wheels which can create a pivot point on which a moment can act
 - Any difference in the direction the airplane is traveling and the direction it is headed will produce a moment about the pivot point of the wheels and the airplane will tend to swerve
- b. Weathervaning
 - The airplane will tend to weathervane into the wind
 - a. This is due to the main landing wheels acting as a pivot point and the greater surface area exposed to a crosswind behind the pivot point
- c. Loss of Directional Control
 - May lead to an aggravated, uncontrolled, tight turn on the ground (Ground Loop)
 - a. Combination of centrifugal force acting on the center of gravity and ground friction on the main wheels resisting it during the loop may cause the airplane to lean enough for the wingtip to contact the ground
 - b. Could impose a great enough sideward force to collapse the landing gear
- d. Aileron Control
 - When decelerating, more and more aileron must be applied into a crosswind to keep the upwind wing from rising
 - a. Less and less airflow over the control surfaces
- e. **CE** - Poor directional control after touchdown

D. Braking

- i. Skidding is not effective
 - a. Max effective braking is brake pressure up to the point that the airplane would begin skidding
 - Not necessary in a normal landing
 - ii. Gently and evenly apply the brakes
 - a. Unless being used to assist a turn
 - iii. **CE** - Improper use of brakes
 - a. Ensure feet are not on the brakes at touchdown, this could result in lost control and blown tires
- E. **CE** - Failure to review airport diagram for runway exit situational awareness to avoid a runway incursion after landing
- a. Have a plan of where you plan to exit the runway and how to taxi to your destination
 - b. Make adjustments as necessary if unable to exit as planned
 - c. Review and be familiar with potential hot spots (be extra cautious for traffic at these spots)

F. After Landing Checklist

- i. Perform once clear of the runway

8. The Crosswind Approach

- A. Landing which must be made while the wind is blowing across rather than parallel to the landing direction
- B. The same basic principles apply to a crosswind and normal approach and landing
- C. Two methods of accomplishing a crosswind approach and landing
 - i. Crab Method
 - a. Easier but requires a high degree of judgment and timing in removing the crab right before touchdown
 - b. Not recommended
 - ii. Sideslip (wing-low) Method
 - a. Recommended



D. Final Approach

i. Sideslip (Wing-Low)

- a. Align the airplane's heading with the centerline of the runway, noting the rate and direction of drift
- b. Promptly apply drift correction
 - Lower the upwind wing
 - a Amount of lowering depends on the drift
 - When the wing is lowered, the airplane will turn in that direction
 - a So, simultaneous opposite rudder pressure is necessary to keep the longitudinal axis of the airplane in aligned with the runway
 - The airplane will be side-slipping into the wind just enough so that the flight path and ground track are aligned with the runway
 - Changes in the crosswind are corrected for accordingly



c. Strong Crosswind

- In the case that it is not possible to maintain the centerline, the wind is too strong to safely land on the particular runway
 - a There is insufficient rudder to maintain a heading with the required bank application
 - b The landing should be made on a more favorable runway

d. Maintain a stabilized approach

- Same as normal, except with the added side slip
- Because you are in a slip, drag is increased, more power will be necessary to maintain a given descent rate

ii. Roundout

- a. Generally made like a normal landing approach, but the crosswind correction is continued as necessary to prevent drifting
 - Don't level the wings
 - 1. This will result in drifting, which results in side loading the gear
- b. Gradually increase the deflection of the elevators and rudder to maintain drift correction as the airplane slows
 - The controls become less and less effective as airspeed is decreased

iii. Touchdown

- a. The touchdown should be made on the upwind main wheel first
 - Maintaining crosswind correction to prevent drift
- b. As the momentum decreases, the weight of the airplane will cause the downwind main wheel to gradually settle onto the runway, then the nosewheel

iv. After Landing Roll

- a. Maintain directional control with rudders
 - With a greater profile behind the main wheels, the airplane will tend to weathervane into the wind
- b. Maintain crosswind control with ailerons
 - Full aileron into the wind
 - a Keeps the upwind wing from rising
 - As the speed decreases, more and more aileron is going to be necessary

9. The Go Around

- A. Used if we cannot maintain a stabilized approach

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- i. Go Around and set up again
- B. Go around anytime safety is compromised or the touchdown point is going to be missed
- C. Go Around Flow
 - i. Full power
 - ii. Landing Flaps are retracted
 - iii. Climb out at V_Y
 - a. Upon reaching V_Y Takeoff Flaps can be retracted

10. Obstructions and Other Hazards to Consider

- A. Wind Conditions
 - i. A strong headwind
 - a. Position the base leg closer
 - b. Increase speed on final approach
 - More positive control
 - Approach speed + $\frac{1}{2}$ the gust factor
 - a EX: Wind at 12 knots gusting to 20 (8 knot gust factor)
 - 1. Approach at 65 knots + 4 knots = 69 knots
 - Less flaps may be expedient in this situation
 - a Follow POH recommendations
- B. Obstacles
 - i. Trees, Towers, Construction equipment
- C. Traffic
 - i. Always looking for other traffic

11. Wind Shear and Wake Turbulence

- A. Wind Shear
 - i. Unexpected change in wind direction and/or wind speed
 - ii. Avoid It
 - a. Never conduct traffic pattern operations in close proximity to an active thunderstorm
 - b. LLWAS (Low Level Wind Shear Alerting System)
 - If available can warn of impending wind shear
 - c. PIREPS
 - Can be very informational
 - iii. Approach into Wind Shear
 - a. Use more power
 - b. Faster Airspeed
 - Add $\frac{1}{2}$ the gust factor to the approach speed
 - c. Stay as high as feasible until necessary to descend
 - d. Go Around at the first sign of a change in airspeed or unexpected pitch change
 - Important to get FULL power and get the airplane climbing
- B. Wake Turbulence
 - i. Jets
 - a. Maintain adequate separation
 - b. Approach
 - Stay above other aircrafts glidepath
 - c. When Landing
 - Land prior to a departing jet's takeoff point
 - Land beyond an arriving jet's touchdown point

Common Errors:

- Improper use of landing performance data and limitations
- Failure to establish approach and landing configuration at appropriate time or in proper sequence
- Failure to establish and maintain a stabilized approach
- Inappropriate removal of hand from throttles
- Improper procedure during roundout and touchdown
- Poor directional control after touchdown
- Improper use of brakes
- Failure to ensure receipt and acknowledgement of landing clearance
- Failure to review airport diagram for runway exit situational awareness to avoid a runway incursion after landing

Conclusion:

Brief review of the main points

As simple and basic a procedure as this seems to be, a lot goes into a well carried out approach. Putting all of these parts together over time will result in a making you a much more confident, safe, and skilled pilot. The fine nuances of a stabilized, well planned approach are well worth the end result the first time you 'grease' a landing.

PTS Requirements:

To determine that the applicant:

1. Exhibits instructional knowledge of the elements of a normal and a crosswind approach and landing by describing:
 - a. How to determine landing performance and limitations.
 - b. Configuration, power, and trim.
 - c. Obstructions and other hazards which should be considered.
 - d. A stabilized approach at the recommended airspeed to the selected touchdown area.
 - e. Course of action if selected touchdown area is going to be missed.
 - f. Coordination of flight controls.
 - g. A precise ground track.
 - h. Wind shear and wake turbulence avoidance procedures.
 - i. Most suitable crosswind procedure.
 - j. Timing, judgment, and control procedure during roundout and touchdown.
 - k. Directional control after touchdown.
 - l. Use of brakes (landplane).
 - m. Use of checklist.
 - n. After landing runway incursion procedures.
2. Exhibits instructional knowledge of common errors related to a normal and a crosswind approach and landing by describing:
 - a. Improper use of landing performance data and limitations.
 - b. Failure to establish approach and landing configuration at appropriate time or in proper sequence.
 - c. Failure to establish and maintain a stabilized approach.
 - d. Inappropriate removal of hand from throttles.
 - e. Improper procedure during roundout and touchdown.
 - f. Poor directional control after touchdown.
 - g. Improper use of brakes (landplane).
 - h. Failure to ensure receipt and acknowledgement of landing clearance.

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- i. Failure to review airport diagram for runway exit situational awareness to avoid a runway incursion after landing.
3. Demonstrates and simultaneously explains a normal or a crosswind approach and landing from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to a normal or crosswind approach and landing.

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