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| Student:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date Completed:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Private & Commercial Pilot Flight Training** |
| **Short Field Takeoff and Max Perform Climb** |
| Objective: |
| To develop the student's proficiency in conducting short-field takeoffs and climbs. |

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| Elements: |
| 1. Factors related to the transfer of airplane weight from the landing gear to the wings as rapidly as possible. 2. Review of wind conditions and takeoff surface. 3. Use of wing flaps. 4. How to align the airplane with the takeoff path without stopping. 5. Initial positioning of flight controls. 6. Power application. 7. Directional control during acceleration on the surface. 8. Crosswind control technique during acceleration on the surface. 9. Lift-off attitude and airspeed. 10. Acceleration in ground effect to climb airspeed (Vy). 11. Track during climb. 12. Use of checklist. |

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| Schedule: | |
| Preflight Discussion | 0:15 |
| Inflight Demonstration and Student Practice | 0:30 |
| Postflight Discussion | 0:15 |
| All Times Dependent on Pilot's Ability | |

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| Equipment: | |
| Aircraft | Drawing Surface and Marking Utensil |

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| Instructor's Actions: | Student's Actions: |
| **PREFLIGHT:**   * Discuss lesson objective * Discuss common student errors in performing the maneuver. * Discuss the FAA's emphasis on safety including collision avoidance and division of attention.   **INFLIGHT:**   * Demonstrate the maneuver. * Coach student practice. * Evaluate student understanding of maneuver.   **POSTFLIGHT:**   * Critique student performance. * Answer student questions. * Assign homework for next lesson. | **PREFLIGHT**   * Discuss lesson objective. * Listens and takes notes. * Resolves Questions.   **INFLIGHT**   * Reviews maneuvers. * Pays attention and asks questions. * Practices maneuver as directed. * Answers questions posed by instructor.   **POSTFLIGHT**   * Ask pertinent questions. * Answers questions posed by instructor. * Critiques own performance. * Completes assigned homework. |

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| Private & Commercial Pilot Flight Training |
| Completion Standards: FAA-H-8081-14AS (Private PTS, IV. E. 1-13) |
| 1. Exhibits knowledge of the elements related to a short-field takeoff and maximum performance climb. |
| 1. Positions the flight controls for the existing wind conditions; sets the flaps as recommended. |
| 1. Clears the area; taxies into takeoff position utilizing maximum available takeoff area and aligns the airplane on the runway center/takeoff path. |
| 1. Applies brakes (if appropriate), while advancing the throttle smoothly to takeoff power. |
| 1. Lifts off at the recommended airspeed, and accelerates to the recommended obstacle clearance airspeed or VX. |
| 1. Establishes a pitch attitude that will maintain the recommended obstacle clearance airspeed, or VX,+10/-5 knots, until the obstacle is cleared, or until the airplane is 50 feet (20 meters) above the surface. |
| 1. After clearing the obstacle, establishes the pitch attitude for VY, accelerates to VY, and maintains VY, +10/-5 knots, during the climb. |
| 1. Retracts the landing gear, if appropriate, and flaps after clear of any obstacles or as recommended by manufacturer. |
| 1. Maintains takeoff power and VY +10/-5 to a safe maneuvering altitude. |
| 1. Maintains directional control and proper wind-drift correction throughout the takeoff and climb. |
| 1. Completes the appropriate checklist. |
| Completion Standards: FAA-H-8081-12B (Commercial PTS, IV. E, 1-13) |
| 1. Exhibits knowledge of the elements related to a short-field takeoff and maximum performance climb. |
| 1. Positions the flight controls for the existing wind conditions, sets flaps as recommended. |
| 1. Clears the area; taxies into takeoff position utilizing maximum available takeoff area and aligns the airplane on the runway center/takeoff path. |
| 1. Applies brakes (if appropriate) while advancing the throttle smoothly to takeoff power. |
| 1. Lifts off at the recommended airspeed, and accelerates to recommended obstacle clearance airspeed, or VX. |
| 1. Establishes a pitch attitude that will maintain the recommended obstacle clearance airspeed, or VX, +5/-0 knots, until the obstacle is cleared, or until the airplane is 50 feet the surface. |
| 1. After clearing the obstacle, establishes the pitch attitude for VY, accelerates to VY, and maintains VY, ±5 knots, during the climb. |
| 1. Retracts the landing gear, if appropriate and flaps after clear of any obstacles or as recommended by manufacturer. |
| 1. Maintains takeoff power and VY ±5 knots to a safe maneuvering altitude. |
| 1. Maintains directional control and proper wind-drift correction throughout the takeoff and climb. |
| 1. Completes appropriate checklist. |

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| Private & Commercial Pilot Flight Training |
| Common Errors: FAA-H-8083-3A (Chapter 5-9) |
| 1. Failure to allow enough room on final to set up the approach, necessitating an overly steep approach and high sink rate. 2. Unstabilized approach. 3. Undue delay in initiating glidepath corrections. 4. Too low an airspeed on final resulting in inability to flare properly and landing hard. 5. Too high an airspeed resulting in floating on roundout. 6. Prematurely reducing power to idle on roundout resulting in hard landing. 7. Touchdown with excessive airspeed. 8. Excessive and/or unnecessary braking after touchdown. 9. Failure to maintain directional control. |

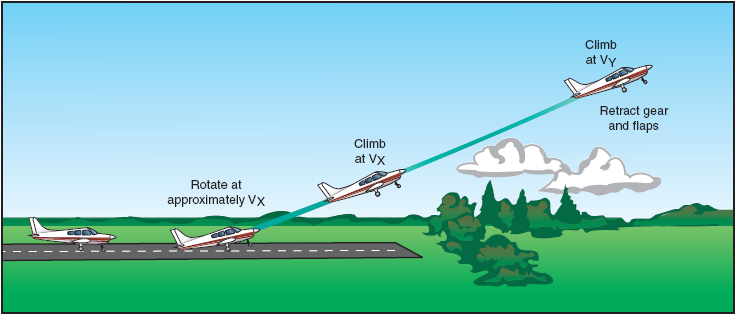
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| References: | |
| FAA-H-8083-3A (Chapter 5-8) | FAA-S-8081-14AS (Private PTS, IV. E. 1-13) |
| AFM/POH | FAA-S-8081-12B (Commercial PTS, IV. E. 1-13) |
| FAA-H-8083-25 | |

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| Things to Remember: |
| Hand on throttle unless trimming until safe altitude. |
| Leave gear on single down until no useable runway remaining. |
| Check POH for flaps or gear retraction first. |
| Differences between short field no obstacle, obstacle clearance, and short with an obstacle. |
| Density Altitude Makes All Fields Short |

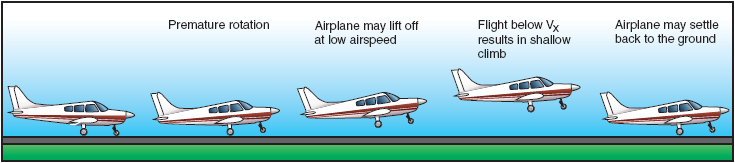
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| Private & Commercial Pilot Flight Training |
| Short Field Takeoff and Maximum Performance Climb Technique: |
| **TAKEOFF ROLL**   1. Configure the airplane for takeoff (Flaps, slats etc.) 2. Line up using as much runway as possible. 3. Apply full takeoff power 4. Adjust pitch attitude for minimum   **LIFT-OFF**   1. Approaching best angle-of-climb speed (VX), the airplane should be smoothly and firmly lifted off, or rotated, by applying back-elevator pressure to an attitude that will result in the best angle-of-climb airspeed (VX) or recommended speed from the POH. 2. After becoming airborne, maintain Vx or recommended speed until obstacles are cleared. 3. Retract the gear once positive rate of climb in seen visually or indicated by flight instruments. 4. Transition to Vy. 5. Retract the flaps in stages are recommended by the POH. |

Instructor notes and visual aids

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| Private & Commercial Pilot Flight Training |
| Short Field Takeoff and Maximum Performance Climb: |
| **DESCRIPTION**  Takeoffs and climbs from fields where the takeoff area is short or the available takeoff area is restricted by obstructions require that the pilot operate the airplane at the limit of its takeoff performance capabilities. To depart from such an area safely, the pilot must exercise positive and precise control of airplane attitude and airspeed so that takeoff and climb performance results in the shortest ground roll and the steepest angle of climb. The achieved result should be consistent with the performance section of the FAA-approved Airplane Flight Manual and/or Pilot’s Operating Handbook (AFM/POH). In all cases, the power setting, flap setting, airspeed, and procedures prescribed by the airplane’s manufacturer should be followed.  In order to accomplish a maximum performance takeoff safely, the pilot must have adequate knowledge in the use and effectiveness of the best angle-of-climb speed (VX) and the best rate-of-climb speed (VY) for the specific make and model of airplane being flown. The speed for VX is that which will result in the  greatest gain in altitude for a given distance over the ground. It is usually slightly less than VY which provides the greatest gain in altitude per unit of time. The specific speeds to be used for a given airplane are stated in the FAA-approved AFM/POH. It should be emphasized that in some airplanes, a deviation of 5 knots from the recommended speed will result in a significant reduction in climb performance. Therefore, precise control of airspeed has an important bearing on the successful execution as well as the safety of the maneuver.  **TAKEOFF ROLL**   * Taking off from a short field requires the takeoff to be started from the very beginning of the takeoff area. * At this point, the airplane is aligned with the intended takeoff path. * If the airplane manufacturer recommends the use of flaps, they should be extended the proper amount before starting the takeoff roll. * This permits the pilot to give full attention to the proper technique and the airplane’s performance throughout the takeoff. * Some authorities prefer to hold the brakes until the maximum obtainable engine r.p.m. is achieved before allowing the airplane to begin its takeoff run. * However, it has not been established that this procedure will result in a shorter takeoff run in all light single-engine airplanes. * Takeoff power should be applied smoothly and continuously without hesitation to accelerate the airplane as rapidly as possible. * The airplane should be allowed to roll with its full weight on the main wheels and accelerated to the lift-off speed. * As the takeoff roll progresses, the airplane’s pitch attitude and angle of attack should be adjusted to that which results in the minimum amount of drag and the quickest acceleration. * In nosewheel-type airplanes, this will involve little use of the elevator control, since the airplane is already in a low drag attitude.   **LIFT-OFF**   * Approaching best angle-of-climb speed (VX), the airplane should be smoothly and firmly lifted off, or rotated, by applying back-elevator pressure to an attitude that will result in the best angle-of-climb airspeed (VX). * Since the airplane will accelerate more rapidly after lift-off, additional back-elevator pressure becomes necessary to hold a constant airspeed. * After becoming airborne, a wings level climb should be maintained at VX until obstacles have been cleared or, if no obstacles are involved, until an altitude of at least 50 feet above the takeoff surface is attained. * Thereafter, the pitch attitude may be lowered slightly, and the climb continued at best rate-of-climb speed (VY) until reaching a safe maneuvering altitude. * Remember that an attempt to pull the airplane off the ground prematurely, or to climb too steeply, may cause the airplane to settle back to the runway or into the obstacles. * Even if the airplane remains airborne, the initial climb will remain flat and climb performance/obstacle clearance ability seriously degraded until best angle-of-climb airspeed (VX) is achieved. * The objective is to rotate to the appropriate pitch attitude at (or near) best angle-of-climb airspeed. * It should be remembered, however, that some airplanes will have a natural tendency to lift off well before reaching VX. * In these airplanes, it may be necessary to allow the airplane to lift off in ground effect and then reduce pitch attitude to level until the airplane accelerates to best angle-of-climb airspeed with the wheels just clear of the runway surface. * This method is preferable to forcing the airplane to remain on the ground with forward- elevator pressure until best angle-of-climb speed is attained. * Holding the airplane on the ground unnecessarily puts excessive pressure on the nosewheel, may result in “**wheelbarrowing**,” and will hinder both acceleration and overall airplane performance.   **INITIAL CLIMB**   * On short-field takeoffs, the landing gear and flaps should remain in takeoff position until clear of obstacles * (or as recommended by the manufacturer) and VY has been established. * It is generally unwise for the pilot to be looking in the cockpit or reaching for landing gear and flap controls until obstacle clearance is assured. * When the airplane is stabilized at VY, the gear (if equipped) and then the flaps should be retracted. * It is usually advisable to raise the flaps in increments to avoid sudden loss of lift and settling of the airplane. * Next, reduce the power to the normal climb setting or as recommended by the airplane manufacturer. |



Short field takeoff



Effect of rotating too soon