

<b>Objectives</b>	<ul style="list-style-type: none"> <li>Develop the skills and knowledge needed to perform a soft field takeoff. The student will also be able to demonstrate this to ACS standards</li> </ul>
<b>Attention</b>	<ul style="list-style-type: none"> <li><b><u>Have you ever wanted to takeoff from a grass runway?</u></b></li> </ul>
<b>Elements</b>	<ul style="list-style-type: none"> <li>Overview</li> <li>Taxi</li> <li>Takeoff Roll</li> <li>Lift-Off</li> <li>Initial climb</li> </ul>
<b>Schedule</b>	<ul style="list-style-type: none"> <li>Review objectives</li> <li>Review material</li> <li>Conclusion &amp; Review</li> </ul>
<b>Equipment</b>	<ul style="list-style-type: none"> <li>White Board &amp; Marker</li> <li>Miniature Aircraft</li> <li>References</li> </ul>
<b>CFI Actions</b>	<ul style="list-style-type: none"> <li>Present lesson</li> <li>Use teaching aids</li> <li>Ask/ answer questions</li> </ul>
<b>Student Actions</b>	<ul style="list-style-type: none"> <li>Participate in discussion</li> <li>Take notes</li> <li>Ask / answer questions</li> <li>Chair Fly at home</li> </ul>
<b>Completion Standards</b>	<ul style="list-style-type: none"> <li>The Lesson Is Complete When the Student Can Demonstrate Knowledge of and Has Demonstrated Proficiency in Soft Field Takeoffs and Climbs, With and Without Obstacles.</li> </ul>

Additional Notes: \_\_\_\_\_

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**CE = Common Error****Introduction****Attention**

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Have you ever wanted to takeoff from a grass runway?

**Overview**

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Review Objectives / Elements

**What**

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A soft field takeoff is a takeoff from a soft, often uneven surface which could cause hazards when performing normal takeoff procedures.

**Why**

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Soft surfaces or long wet grass surfaces can reduce the aircraft's acceleration so much during the takeoff roll that adequate takeoff speed may not be attained if normal takeoff techniques are used.

**How**

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**Overview****Goals of a soft field takeoff**

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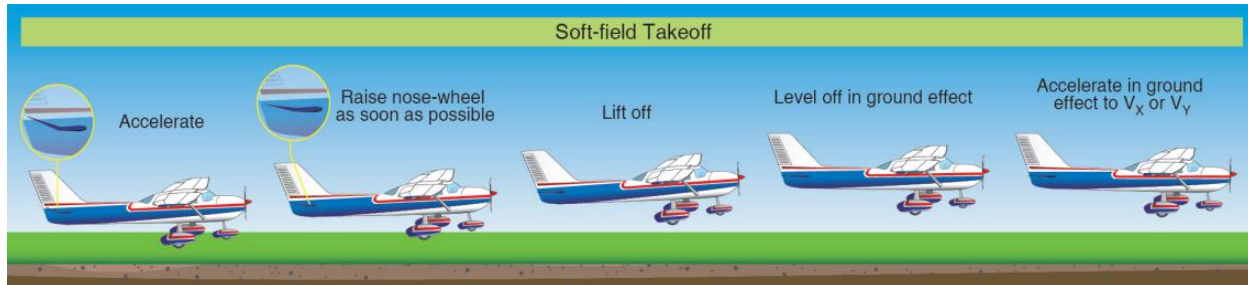
- To get the airplane airborne as quickly as possible
  - Surfaces such as tall grass, soft sand, mud, and snow reduce the airplane's acceleration during the takeoff roll so much that achieving takeoff speeds may not be possible using the normal takeoff technique.
  - Avoid damage to gear due to uneven terrain.
- To transfer as much weight as possible to the wings
  - This minimizes surface friction on the tires.
- Utilize ground effect to accelerate

**Basics**

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- **Keep the airplane Moving**
  - Stopping could result in the aircraft getting stuck
- **Maintain back pressure**
  - We want to keep as much weight off the nose wheel as possible to prevent it getting stuck or digging into the ground
- **Preform a "wheelie"**
  - Establish a high Pitch attitude or AOA as soon as possible

- This transfers the weight of the airplane to the wings as fast as possible
- **Accelerate in ground effect until reaching climb speed**



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## Taxi

### Taxi General Safety:

- At a towered field **DO NOT** cross the hold short bars unless cleared to
- If uncontrolled, announce your intentions on CTAF **before** taxiing onto the runway
- Before taxiing onto the runway visually clear the area
  - Check the final approach and the rest of runway for traffic
  - **Never taxi out with another plane on final approach**
- **CE** - Improper runway incursion avoidance procedures
- **CE** - Failure to adequately clear the area

### Soft field Taxi Procedures:

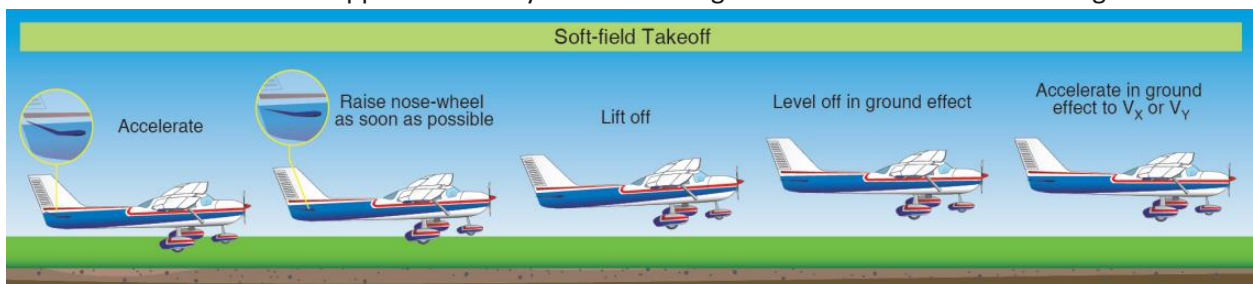
- **Keep the elevator fully aft for the entire taxi**
  - This keeps the weight on the nose gear as low as possible, preventing it from getting stuck
  - Taxiing may require more power than the pilot is used to due to the increased surface friction
- **Keep turns shallow and don't stop**
  - Stopping on a soft surface, such as mud or snow, might bog the airplane down; therefore, it should be kept in continuous motion with sufficient power while lining up for takeoff

## Takeoff Roll

- **Determine the Wind direction and apply appropriate correction**
  - Same as normal takeoff
- **Maintain back pressure on elevator and maintain movement**
- **While aligning the aircraft with the centerline, takeoff power is added smoothly and rapidly**
  - **Don't stop to align aircraft with centerline**
- **CE – Failure to cross check engine instruments for indications of proper operation after applying power**
  - Ensure proper engine indications
- **CE – Poor directional control**
  - Use rudder pressure to counteract the yawing forces and maintain centerline
- **The initial momentum required for takeoff is going to require much more power than normal**
- **Anticipate a slow acceleration**
- **Initially, elevator will be held in the full aft position**
  - As the aircraft accelerates and the nose lifts off the ground, release some back pressure to maintain the nose high attitude (where the nose wheel is off the ground)
    - **Site Picture:** The cowling should be on the horizon
    - About 5 degrees of pitch
- **CE – Insufficient back elevator pressure during the initial takeoff roll resulting in an inadequate angle of bank**
- **As speed increases, back pressure must be reduced to avoid an excessive angle of attack / pitch attitude**
  - **Too much back pressure can increase drag or even worse, cause a tail strike**
- **Continue to use rudder to keep the aircraft on the center of the runway**
  - No ailerons to control direction
- **The aircraft will then fly itself off the ground once it has enough lift.**

## Lift-Off

- **After the airplane is airborne, the nose can be gently lowered so that the aircraft has time to accelerate to  $V_x$  or  $V_y$  in ground effect.**
- **CE – Abrupt or excessive elevator control while attempting to level off and accelerate after lift-off**
  - The controls should be applied smoothly to avoid letting the aircraft touch back on the ground



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- Keep in mind that as airspeed builds, more forward elevator pressure will be required to keep the aircraft in ground effect.
  - This is due to the increase in lift as airspeed increases
- Ailerons and Rudder
  - While over the runway, use rudder to account for drift
- Why are we staying in ground effect?
  - Ground effect reduces induced drag
- For ground effect to be effective, the wing must be within  $\frac{1}{2}$  of its wingspan of the ground
  - **CE** - Attempting to climb out of ground effect area before attaining sufficient climb speed
    - If the aircraft climbs out of ground effect too early, the increase in induced drag may result in marginal to no climb performance.
- The airplane must stay in ground effect until  $V_x$  or  $V_y$  is achieved.
- **CE** - Allowing the airplane to settle resulting in an inadvertent touchdown after lift-off
  - Maintain back pressure to remain in ground effect, and do not attempt to climb out of ground effect until reaching a safe climb airspeed
- **CE** - Improper lift-off procedures
  - Maintain back pressure, adjust as necessary to keep the nose wheel off the ground without striking the tail, once airborne apply forward pressure as necessary to remain in ground effect until reaching the required climb speed

## Lift-Off

### Leaving Ground Effect

- **CE** – Attempting to Climb out of ground effect before attaining sufficient climb speed
  - Do not leave ground effect until reaching  $V_x$  or  $V_y$
- **CE** – Improper Climb attitude, Power setting, and airspeed ( $V_x$  or  $V_y$ )
  - Set the pitch attitude for the airspeed desired ( $V_x$  or  $V_y$ )
  - Leave max power (or takeoff power)
- **CE** – Failure to anticipate an increase in pitch attitude as the airplane climbs out of ground effect
  - As the aircraft climbs out of ground effect, back pressure will need to be increased
- After a positive rate of climb is established and the airplane has accelerated to  $V_x$  or  $V_y$ , climb out as usual
- Soft fields are often short fields ( $V_x$  will be used more likely than not)
- If departing from a wet/slushy airstrip, the gear should not be retracted immediately, allowing it to air dry
  - If cold, cycle multiple times to avoid freezing
- If climbing to avoid an obstacle, climb and  $V_x$  until the obstacle is cleared
  - After clearing, the airspeed may be increased to  $V_y$  and power can be adjusted if needed
- After takeoff checklist
- **CE** – Improper use of checklists
  - Be sure the airplane is in the correct configuration for the climb

## Common Errors

- Improper runway incursion avoidance procedures
- Failure to adequately clear the area
- Insufficient back elevator pressure during the initial takeoff roll resulting in an inadequate angle of attack
- Failure to cross check engine instruments for indications of proper operation after applying power
- Poor directional control
- Improper lift-off procedures
- Climbing too steeply after lift-off
- Abrupt and/or excessive elevator control while attempting to level off and accelerate after lift-off
- Allowing the airplane to “mush” or settle resulting in an inadvertent touchdown after lift-off
- Attempting to climb out of ground effect area before attaining sufficient climb speed
- Improper climb attitude, power setting, and airspeed (V<sub>X</sub> or V<sub>Y</sub>)
- Failure to anticipate an increase in pitch attitude as the airplane climbs out of ground effect
- Improper use of checklists

## Conclusion & Review

### Briefly Review the Main Lesson Points

Anytime taking off from a soft field runway, be as efficiently as possible and get the weight off the wheels of the airplane and onto the wings

### Review

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1. Procedures before taxiing onto the runway or takeoff area to ensure runway incursion avoidance. Verify ATC clearance/no aircraft on final at non-towered airports before entering the runway and ensure correct takeoff runway positioning of the airplane with consideration for other aircraft, surface conditions, and wind.
2. Soft-field takeoff and lift-off procedures.
3. Initial climb attitude and airspeed, (V<sub>X</sub>, if an obstacle is present (50 feet AGL), or V<sub>Y</sub>).
4. Proper use of checklist.