



Visualized Flight Maneuvers Handbook

For High Wing Aircraft
Fourth Edition



For Instructors and Students

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Aviation Supplies & Academics, Inc.
Newcastle, Washington

*Visualized Flight Maneuvers Handbook
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Fourth Edition*

Based on original book by Harold J. Holmes,
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None of the material in this handbook supersedes
any operational documents or procedures issued
by the Federal Aviation Administration, aircraft
and avionics manufacturers, flight schools, or the
operators of the aircraft.

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PREFACE

The purpose of this handbook is threefold:

1. To provide the student with a more thorough understanding of the basic parts of each flight maneuver, in order to better prepare them for each flight instruction period;
2. To provide a foundation for later formal training for private, commercial, or flight instructor candidates;
3. To create a safer and more competent pilot.

This book should be used as a supplement to the current FAA Certification Standards for the certificate being sought. For a full discussion of each maneuver, refer to the *Airplane Flying Handbook* (FAA-H-8083-3). Airplane manufacturer recommendations should be checked before beginning any maneuver.

Maneuvers required by the FAA Certification Standards for the Sport, Private, Commercial, and Flight Instructor certificates are illustrated in this book. The minimum requirements established in the FAA Certification Standards for each certificate accompany each maneuver. Flight Instructor applicants are required to meet the Commercial Pilot skill level. For those maneuvers that are Private Pilot-only, the Flight Instructor applicant is expected to perform the maneuvers more precisely than a Private Pilot applicant, as determined by the examiner.

Where it is appropriate, space has been provided for you to enter the tire pressures, tank capacities, airspeeds, power settings, etc. that apply to the airplane being flown.

Before practicing each maneuver, remember to complete the necessary preparations. Memory aid: **AAACT** (“act”)

- A**rea terrain appropriate for maneuvering, and emergency landing area available
- A**irspeed maneuvering speed (V_A) or as designated by practical test standards
- A**ltitude as designated by practical test standards
- C**learing turns clear area for traffic
- T**echnique as designated by FAA Certification Standards

The maneuvers are visual, and require you to keep your center of attention outside the aircraft. When practicing the maneuvers, use outside references to perform the maneuver, then cross-check by scanning the instruments inside the cockpit—look outside, peek inside.

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AIRCRAFT REVIEW

Aircraft Model and Type:

1. What is the normal climb-out speed? _____
2. What is the best rate-of-climb speed (V_Y)? _____
3. What is the best angle-of-climb speed (V_X)? _____
4. What is the maximum flaps-down speed (V_{FE})? _____
5. What is the maximum gear-down speed (V_{LE})? _____
6. What is the stall speed in a normal landing configuration (V_{S0})? _____
7. What is the clean (flaps and gear up) stall speed (V_{S1})? _____
8. What is the approach-to-landing speed? _____
9. What is the maneuvering speed (V_A)? _____
10. What is the never-exceed speed (V_{NE})? _____
11. What is the maximum structural cruising speed (V_{NO})? _____
12. What engine-out glide speed will give you the maximum range? _____
13. What airspeed is used for a
Short-field takeoff? _____ Short-field landing? _____
Soft-field takeoff? _____ Soft-field landing? _____
14. What is the service ceiling? _____
15. What is the make and horsepower of the engine?

16. What is the estimated true airspeed at 5,000 feet and 65% power? _____
17. What RPM or combination of RPM and manifold pressure yields 65% power at 5,000 feet MSL?
_____ RPM _____ MP
18. How many gallons of fuel are consumed per hour at 65% power at 5,000 feet MSL? _____

19. How many usable gallons of fuel can your aircraft carry? _____
20. Where are the fuel tanks located and what are their capacities?
Main tank _____ gallons _____
Left tank _____ gallons _____
Right tank _____ gallons _____
Rear tank _____ gallons _____
Auxiliary tanks _____ gallons _____
21. With full fuel, 65% power, at 5,000 feet, allowing a 45 minute reserve, what is the maximum duration (in hours)? _____
22. What speed will give you the best glide ratio? _____
23. What is the octane rating and color of the fuel used by the aircraft? _____
24. How do you drain the fuel sumps?

25. What weight of oil is used? _____
26. Is the landing gear fixed, manual, hydraulic, or electric? _____ If retractable, what is the back-up system for lowering the gear? _____
27. What is the maximum demonstrated allowable crosswind component for the aircraft? _____
28. How many persons will the aircraft safely carry with full fuel? _____
29. What is the maximum allowable weight the aircraft can carry in the baggage compartments? _____
30. What takeoff distance is required to clear a 50-foot obstacle at maximum gross weight at a pressure altitude of 5,000 feet and 90°F (assume no wind and a hard-surfaced runway)? _____
31. What would be the answer to Question 30 if the takeoff was made from sea level pressure altitude?

32. Does high humidity increase or decrease the takeoff distance? _____

33. What landing distance is required at 2,300 pounds at a pressure altitude of 2,000 feet and standard temperature (assume no wind or obstacle)?

34. How do you determine pressure altitude?

35. What is your maximum allowable useful load?

36. Solve the weight and balance problem for the flight plan you intend to fly. If you plan to fly solo, also solve the problem for a 180-pound passenger in each seat. Does your load fall within the weight and balance envelope? _____ What is your gross weight? _____ If you solved the problem with 180-pound passengers in each seat, how much fuel could you carry? _____ Where would this fuel be tanked? _____ If you carry full fuel, how much baggage could you carry? _____ Where would this baggage be placed? _____

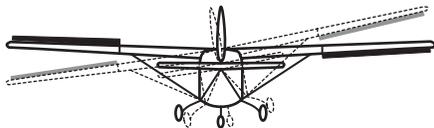
V Speeds

V_A	Design maneuvering speed
V_F	Design flap speed
V_{FE}	Maximum flap extended speed
V_{LE}	Maximum landing gear extended speed
V_{LO}	Maximum landing gear operating speed
V_{NE}	Never-exceed speed
V_{NO}	Maximum structural cruising speed
V_{S0}	Stalling speed or the minimum steady flight speed in the landing configuration
V_{S1}	Stalling speed or the minimum steady flight speed obtained in a specific configuration
V_X	Best angle-of-climb speed
V_Y	Best rate-of-climb speed

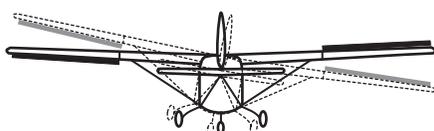
Ailerons

The primary use of the ailerons is to bank, or roll, the airplane around the longitudinal axis. Banking the wings results in the airplane turning in the direction of the bank.

- When control wheel (yoke) is turned to the left, left aileron is raised and airplane rolls to the left.



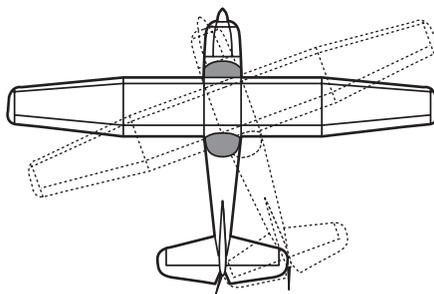
- When control wheel (yoke) is turned to the right, right aileron is raised and airplane rolls to the right.



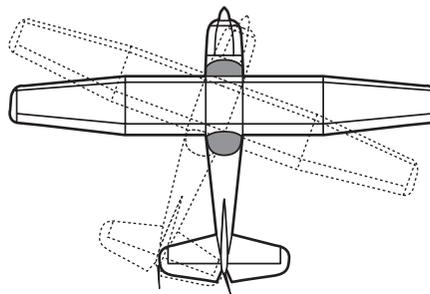
Rudder

The rudder is used to control the direction (left or right) of yaw about the airplane's vertical axis.

- When left rudder is pushed, the nose pivots to the left.



- When right rudder is pushed, the nose pivots to the right.



Cockpit Controls

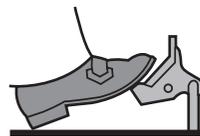
Yoke

Hold yoke with your left hand. Your grip should be firm but relaxed.



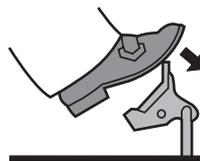
Rudder pedals

Place your heels on the floor and toes, or the balls of the feet, on the rudder pedals. Pressures can be exerted more accurately by the toes, or the balls of the feet, than by the instep.



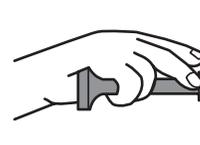
Brakes

To apply the airplane brakes, depress the top of the rudder pedals. Do the same when setting the parking brake.



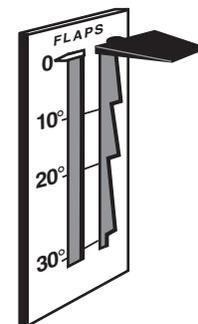
Throttle

Operate the throttle with the right hand. Hold the throttle so that small changes can be made smoothly. Use several fingers to act as a stop against contact with the panel or quadrant. Do not hold the throttle entirely by its knob or lever handle.



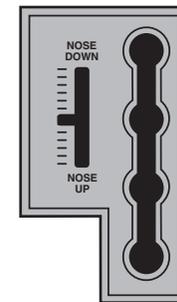
Flaps

Flaps increase the wing's lift by increasing its area or its camber. Flaps also cause drag because they extend beneath the wing. The lift/drag ratio is determined by the degree of flap extension. Using flaps lowers the wing's stalling speed, and increases the rate of descent without an increase in airspeed.

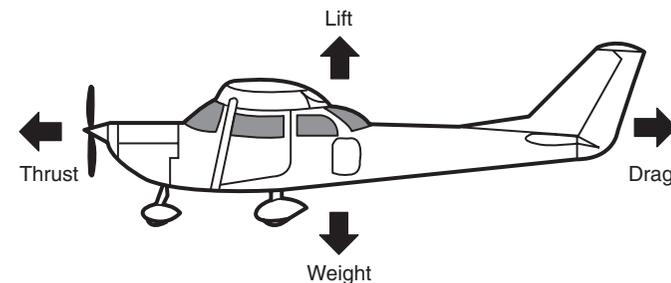


Trim Tab

The purpose of trim tab is to relieve control pressure on the flight controls. Set trim for airspeed (attitude) desired. The trim tab is operated by the trim wheel.

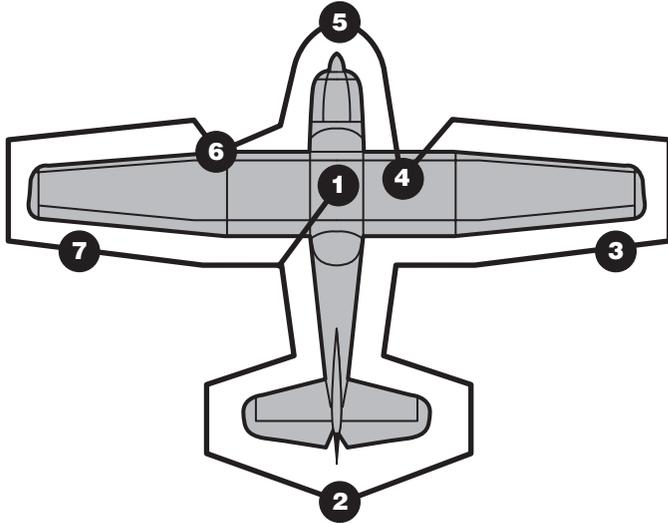


Forces Acting on the Airplane in Flight



PREFLIGHT OPERATIONS

Check Manufacturer Recommendations



Upon approaching airplane:

- Perform visual check for general condition of aircraft
- Remove accumulations of frost, ice, or snow from wing
- Have flashlight available for night flight

1

- Check aircraft paperwork

Remember:

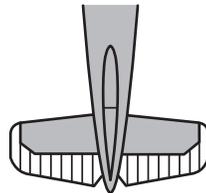
- A**irworthiness
- R**egistration
- O**wner's manual
- W**eight and balance
- E**quipment list

- Check pilot's paperwork, including valid pilot certificate and medical certificate
- Set parking brake
- Remove control wheel lock
- Ignition switch OFF
- Mixture idle cut-off

- Master switch ON
- Check fuel quantity
- Flaps down
- Turn aircraft lights on
- Visually check aircraft lights are operational and not damaged
- Turn aircraft lights off
- Master switch OFF
- Fuel selector on BOTH

2

- Inspect general condition of fuselage, empennage, horizontal stabilizer, and tail light
- Remove control surface lock
- Disconnect tail tie-down
- Check elevator for freedom of movement, cable condition, cotter pins



- Check rudder for freedom of movement, cable condition, cotter pins



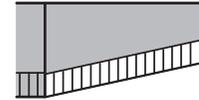
- Inspect general condition of trim tab



- Inspect general condition of empennage and fuselage

3

- Inspect right flap, on track, rod and hinges free
- Check right aileron for freedom of movement, hinges, counterweights, control linkage, security

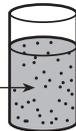


- Check condition of right wing tip
- Check condition of right wing leading edge and bottom surface

4

- Remove right wing tie-down
- Check main wheel general condition and tire inflation *Manufacturer Recommended tire inflation _____ psi*
- Check brakes, hydraulic line, no leaks
- Check fuel condition through quick drain

Check for water, sediment and color.

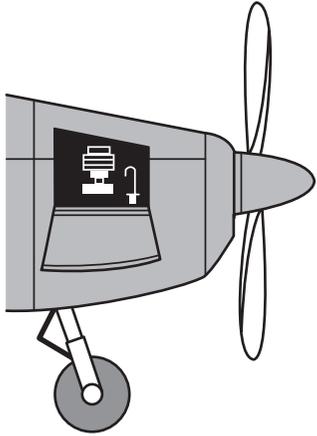


- RED-80/87 octane
- BLUE-100 LL
- GREEN-100 octane

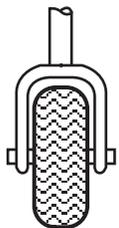
- Visually check fuel quantity and secure cap *Tank capacity _____ gallons*
- Inspect condition of wing top surface

5

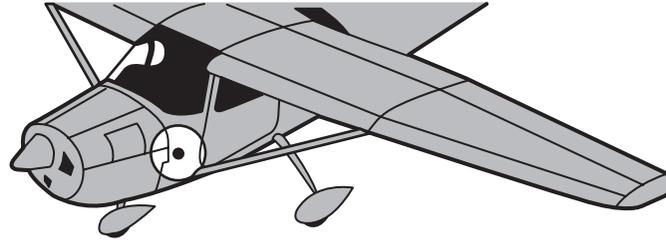
- Check oil level per manufacturer recommendations



- Fill oil for extended flight
- Make sure dipstick is properly seated
- Check cowl access door and inspect covers for security
- Check engine for signs of oil or fuel leaks
- Check ignition wires tight
- Check fittings and motor mount
- Drain fuel strainer in engine compartment, check for contaminants, water, color
- Check for bird or animal nests
- Check exhaust for tightness and cracks
- Check propeller and spinner for nicks, dents, cracks, and security
- Check alternator belt and attach bolts are tight and secure
- Check carburetor air filter and intake screen for foreign matter
- Check nose wheel strut clean and exposed at least 2 inches

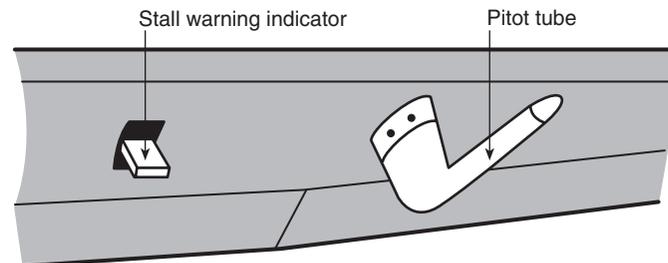


- Remove nose gear chock
- Check nose gear tire, cuts, bruise, inflation meet manufacturer recommendations
- Check nose gear actuating rods are straight
- Check windshield and cabin windows for cleanliness and no cracks
- Inspect static source on side of fuselage for blockage



6

- Remove left wing tie-down
- Check main wheel general condition and tire inflation
Manufacturer Recommended tire inflation _____ psi
- Check brakes, hydraulic line, no leaks
- Check fuel condition through quick drain
- Visually check fuel quantity and secure cap
Tank capacity _____ gallons
- Inspect condition of wing top surface
- Check left wing leading edge and bottom surface
- Remove pitot tube cover
- Check pitot tube opening for blockage
- Check fuel tank vent opening for blockage
- Check stall warning vent opening for blockage and stall warning vane for freedom of movement



7

- Check condition of left wing tip
- Check left aileron for freedom of movement, hinges, counterweights, control linkage, security
- Inspect left flap, on track, rod and hinges free

General Checks:

- Check underbelly of airplane for excess oil and dirt
- Check baggage is secure and baggage compartment door is closed
- Check all windows are clean and free of cracks
- Inspect the airplane with reference to the checklist
- Verify the airplane is in safe flight condition

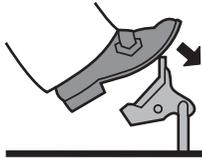
STARTING AIRPLANE

Check Manufacturer Recommendations

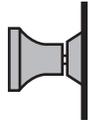
- Complete preflight inspection (see Page 4)
- Complete passenger briefing
- Adjust and lock seat, seatbelts, shoulder harnesses



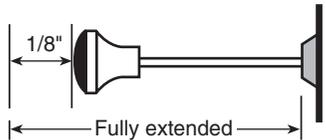
- Test and set brakes



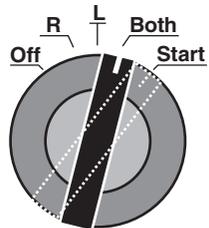
- Check circuit breakers in
- All electrical equipment off
- Fuel selector valve on BOTH
- Prime as required (2-6 strokes for cold engine, 0 strokes for warm engine)
- Lock primer
- Carburetor heat COLD (full in)



- Throttle OPEN 1/8 inch



- Mixture RICH (full in) below 3,000 feet density altitude, or lean to maximum RPM at full throttle at higher density altitudes
- Clear propeller area, and call CLEAR PROP
- Master switch ON
- Ignition switch START (release when engine starts)



- Check oil pressure is in the green within 30 seconds
- Check starter disengaged (if starter were to remain engaged, ammeter would indicate full scale charge with engine running at 1,000 RPM)
- Lights ON as required
- Radios ON
- Flaps UP

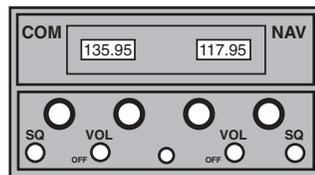
BEFORE-TAKEOFF CHECK

Check Manufacturer Recommendations

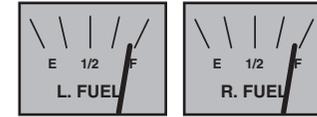
- Complete preflight inspection (see Page 4)
- Complete starting airplane check (see Page 6)
- Position aircraft to avoid run-up over loose gravel or blasting other aircraft
- Set parking brake
- Check seats, seatbelts, shoulder harnesses secure



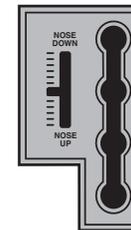
- Close and lock cabin doors and windows
- Throttle to 1,700 RPM
- Check both magnetos (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos)
- Check carburetor heat for RPM drop
- Check engine instruments are in green arc
- Check ammeter is functioning properly
- Check suction gauge is in green arc
- Throttle to IDLE
- Set radios and avionics



- Check fuel quantity



- Check airspeed indicator—zero
- Check attitude indicator—erect and horizon adjusted
- Check altimeter—set barometric pressure or field elevation
- Check turn coordinator—during taxi
- Check heading indicator—during taxi, and set to magnetic compass or runway heading
- Check vertical speed indicator—zero
- Check flight controls are free and correct
- Mixture RICH (full in) below 3,000 feet density altitude, or lean to maximum RPM at full throttle at higher density altitudes
- Carburetor heat COLD (full in)
- Verify fuel selector on BOTH
- Set elevator trim for takeoff



- Set flaps for takeoff
- Aircraft lights ON
- Pitot heat as required
- Transponder on ALT
- Note time off

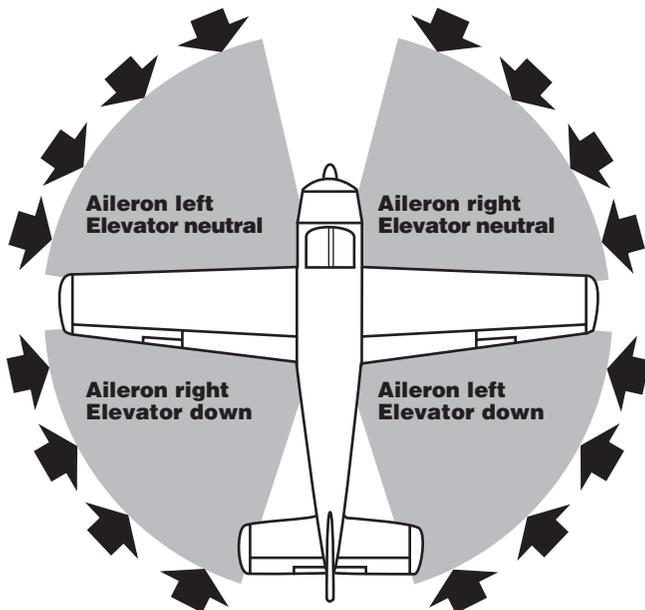
TAXIING

(Private, Sport, Commercial, CFI)

Objective: Safely maneuver the airplane on the ground.

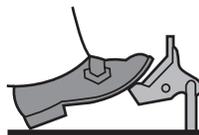
Task:

- After engine start, align heading indicator with magnetic compass
- Obtain clearance to taxi
- Hold yoke to apply crosswind taxi corrections. Memory aid: Fly into, dive away

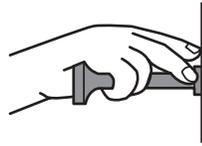


➔ **Indicated Wind Direction** Taxiing

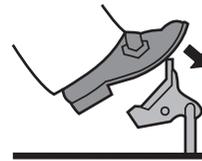
- Rest heels on the floor



- Reduce power to IDLE
- Release parking brake
- Apply sufficient power with the throttle to start airplane moving forward



- Reduce power to idle and gently test brakes



- Apply sufficient power to begin taxiing again
- Adjust power to maintain safe taxiing speed (a fast walking pace or less)
- More power may be required to start moving than is required to keep moving
- Steering is not possible until the airplane is rolling forward
- Control steering with the rudder pedals, and if necessary, differential braking
- While turning airplane, make sure the heading indicator rotates in the direction of turn (right turn increases numbers, left turn decreases numbers)



- While turning airplane, make sure the turn indicator deflects in the direction of the turn
- While turning airplane, make sure the coordination ball shows a skid in the opposite direction of the turn



Evaluation:

- Check brakes immediately after airplane begins moving
- When brakes are used, close throttle (do not use power against brakes)
- Use low power setting when taxiing, 1,000 RPM or less
- Position flight controls properly for existing wind conditions
- Extend courtesy to open hangars, buildings, people (when taxiing, debris, air, and noise is blown opposite the direction of travel)
- Keep speed under control at all times; no faster than would be safe without brakes (fast walking pace)
- Slow down before attempting turns
- Avoid sudden bursts of throttle and sharp braking, especially in strong quartering tailwinds
- Observe local taxi rules, ATC instructions, and airport markings
- Be alert for hazards such as ground obstructions, snow banks, gas pumps, ground vehicles, other aircraft (parked or moving)
- Practice situational awareness and runway incursion avoidance procedures
- Use a taxi chart during taxi
- Complete the appropriate checklist

NORMAL TAKEOFF & CLIMB

(Private, Sport, Commercial, CFI)

Objective: Takeoff and climb out to the downwind leg of the traffic pattern.

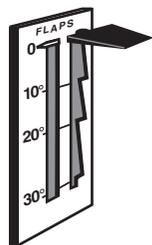
Task: Check Manufacturer Recommendations

1

- Complete preflight inspection (see Page 4)
- Complete starting airplane check (see Page 6)
- Taxi to the upwind runway

2

- Complete before-takeoff check (see Page 6)
- Wing flaps 0° for normal takeoff



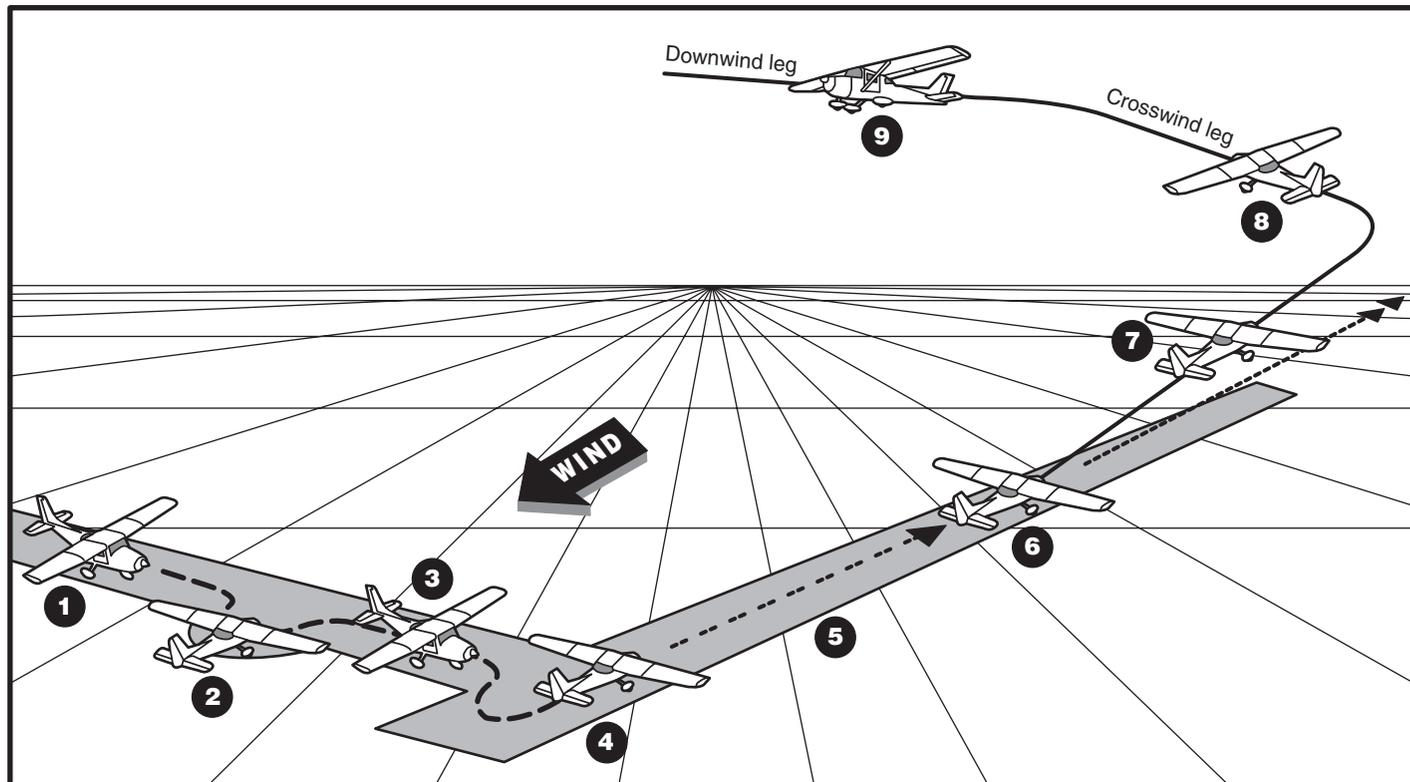
- Know local airport traffic pattern and altitude procedures
- Practice situational awareness and runway incursion avoidance procedures

3

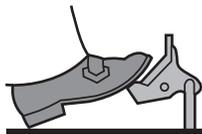
- Obtain takeoff and departure clearances, if required
- Look out and check that runway and approaches are all clear

4

- Line up on runway centerline, nose wheel straight
- Select a reference point straight ahead for tracking



- Keep heels on floor, and toes on rudder pedals, not brakes



- Apply full throttle smoothly and positively



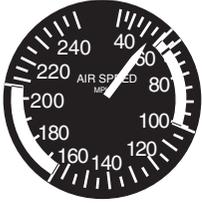
5

- Keep straight with rudder
- Keep wings level with aileron
- Check RPM for full power
- Check engine instruments are in the green arc
- Ease the weight off nose wheel as elevator becomes effective

Continued

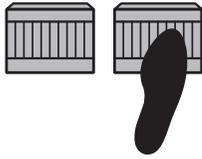
6

- Leave runway at lift-off speed



Manufacturer Recommended lift-off speed _____ knots

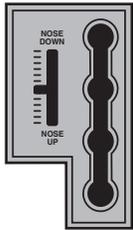
- Use right rudder to offset torque as required



- Keep right hand on the throttle

7

- Establish the attitude that results in V_Y with full throttle
 Manufacturer Recommended V_Y _____ knots
- Trim off any control pressure



- Maintain wings level with aileron, coordinate with rudder



- Retract gear after positive rate of climb is established, and a landing cannot be made on remaining runway
- Scan for traffic
- Maintain a straight track over the extended runway centerline

8

- Beyond end of runway and within 300 feet of traffic pattern altitude, make a climbing turn to crosswind leg (bank angle 20° maximum)
- Allow for wind drift to keep a square pattern
- Maintain climb speed and continue to climb to pattern altitude
- Level off at pattern altitude
- Scan for traffic

9

- Within 1/2 to 1 mile from the runway, make a medium turn to downwind leg (bank angle 30° maximum)
- Scan for traffic
- To depart the traffic pattern, either climb straight out from the upwind leg, or turn 45° beyond the departure end of the runway after reaching pattern altitude

Evaluation:

- Use 0° (normal takeoff) flap setting
- Clear area and align airplane on runway centerline
- Advance throttle smoothly to takeoff power
- Rotate and lift off at the recommended airspeed and accelerate to V_Y
- Establish pitch attitude for V_Y and maintain V_Y during the climb (+10/-5 knots for Private and Sport, ± 5 knots for Commercial and CFI)
- Retract landing gear after a positive rate of climb is established
- Maintain takeoff power to a safe maneuvering altitude
- Maintain directional control and proper wind-drift correction throughout takeoff and climb
- Comply with noise abatement procedures
- Complete the appropriate checklist

CROSSWIND TAKEOFF & CLIMB

(Private, Sport, Commercial, CFI)

Objective: Takeoff and climb out to the downwind leg of the traffic pattern with a crosswind component.

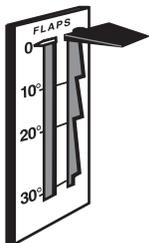
Task: Check Manufacturer Recommendations

1

- Complete preflight inspection (see Page 4)
- Verify crosswind component will not be exceeded
Manufacturer Recommended crosswind component
_____ knots
- Complete starting airplane check (see Page 6)
- Taxi to crosswind runway

2

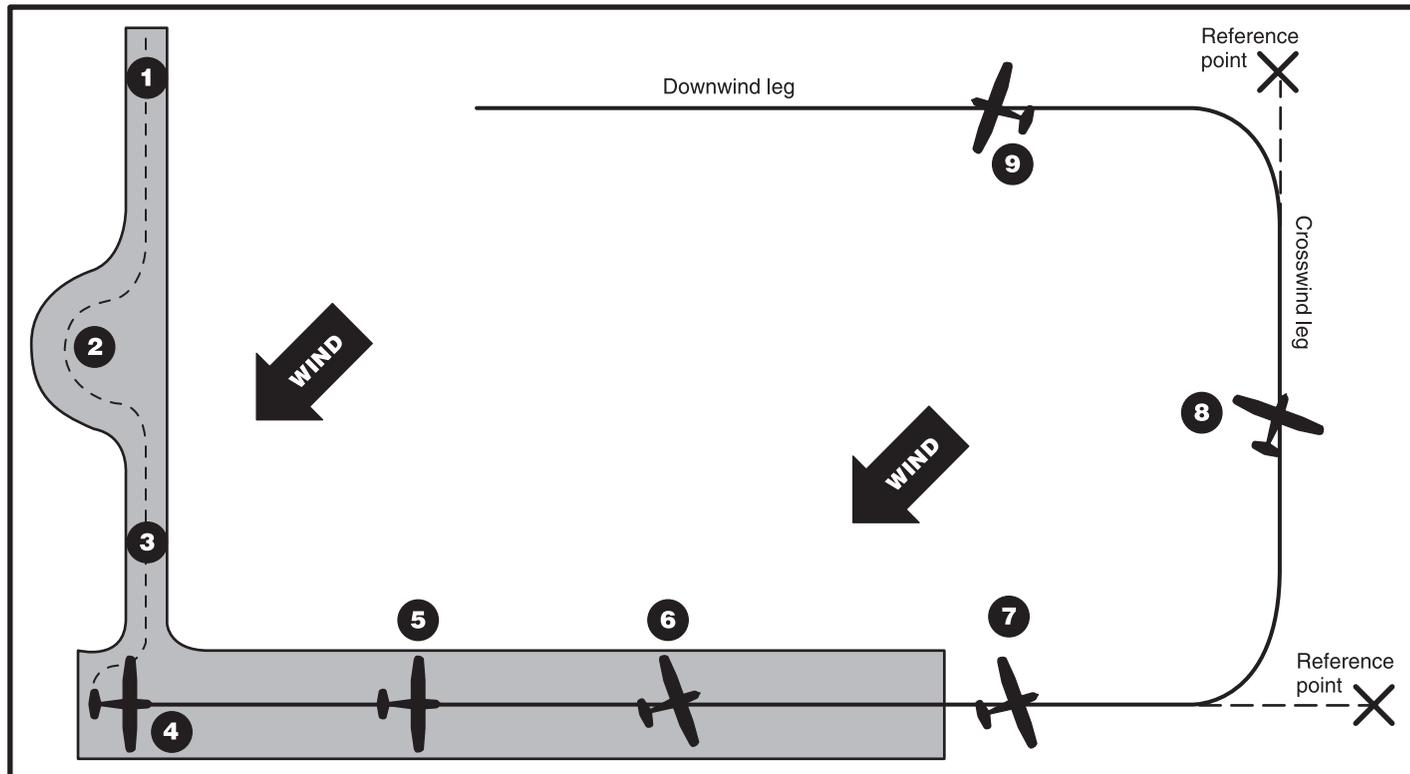
- Complete before-takeoff check (see Page 6)
- Wing flaps 0° for crosswind takeoff



- Know local airport traffic pattern and altitude procedures

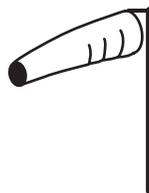
3

- Obtain takeoff and departure clearance, if required
- Look out and check that runway and approaches are all clear

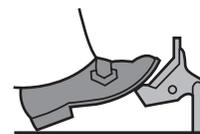


4

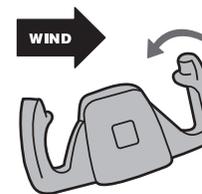
- Line up on runway centerline, nose wheel straight
- Check the windsock



- Select a reference point straight ahead for tracking
- Keep heels on floor, and toes on rudder pedals, not brakes



- Hold full aileron into wind



- Apply full throttle smoothly and positively



Continued

5

- Keep straight with rudder
- Continue to hold aileron into wind and reduce deflection as speed increases
- Hold the nose wheel on the ground
- Check RPM for full power
- Check engine instruments are in the green arc

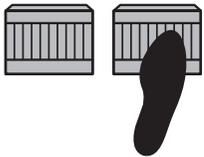
6

- Cleanly leave runway slightly above normal lift-off speed

Manufacturer Recommended lift-off speed ____ knots



- Use right rudder to offset torque as required

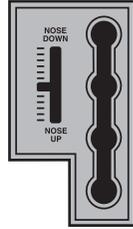


- Keep right hand on the throttle
- Turn into wind to correct for drift

7

- Establish attitude that results in V_Y with full throttle
Manufacturer Recommended V_Y _____ knots

- Trim off any control pressure



- Maintain crab angle with aileron, coordinate with rudder



- Retract gear after positive rate of climb is established, and a landing cannot be made on remaining runway
- Scan for traffic
- Maintain a straight track over the extended runway centerline using a reference point

8

- Beyond end of runway and within 300 feet of traffic pattern altitude, make a climbing turn to crosswind leg (bank angle 20° maximum)
- Allow for wind drift by crabbing, to keep a square pattern
- Maintain climb speed and continue to climb to pattern altitude
- Level off at pattern altitude
- Scan for traffic

9

- Within 1/2 to 1 mile from runway, make a medium turn to downwind leg (bank angle 30° maximum)
- Continue to crab to correct for wind drift
- Scan for traffic
- To depart the traffic pattern, either climb straight out from the upwind leg, or turn 45° beyond the departure end of the runway after reaching pattern altitude

Evaluation:

- Use 0° (crosswind takeoff) flap setting
- Position the flight controls for existing wind conditions
- Clear area and align airplane on runway centerline
- Advance throttle smoothly to takeoff power
- Rotate and lift off at the recommended airspeed and accelerate to V_Y
- Establish pitch attitude for V_Y and maintain V_Y during the climb (+10/-5 knots for Private and Sport, ±5 knots for Commercial and CFI)
- Retract landing gear after a positive rate of climb is established
- Maintain takeoff power to a safe maneuvering altitude
- Maintain directional control and proper wind-drift correction throughout takeoff and climb
- Comply with noise abatement procedures
- Complete the appropriate checklist

SOFT-FIELD TAKEOFF & CLIMB

(Private, Sport, Commercial, CFI)

Objective: Get the airplane airborne as quickly as possible to eliminate drag caused by tall grass, sand, mud, and snow, and climb out to the downwind leg of the traffic pattern.

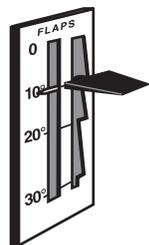
Task: Check Manufacturer Recommendations

1

- Complete preflight inspection (see Page 4)
- Complete starting airplane check (see Page 6)
- Taxi to upwind runway

2

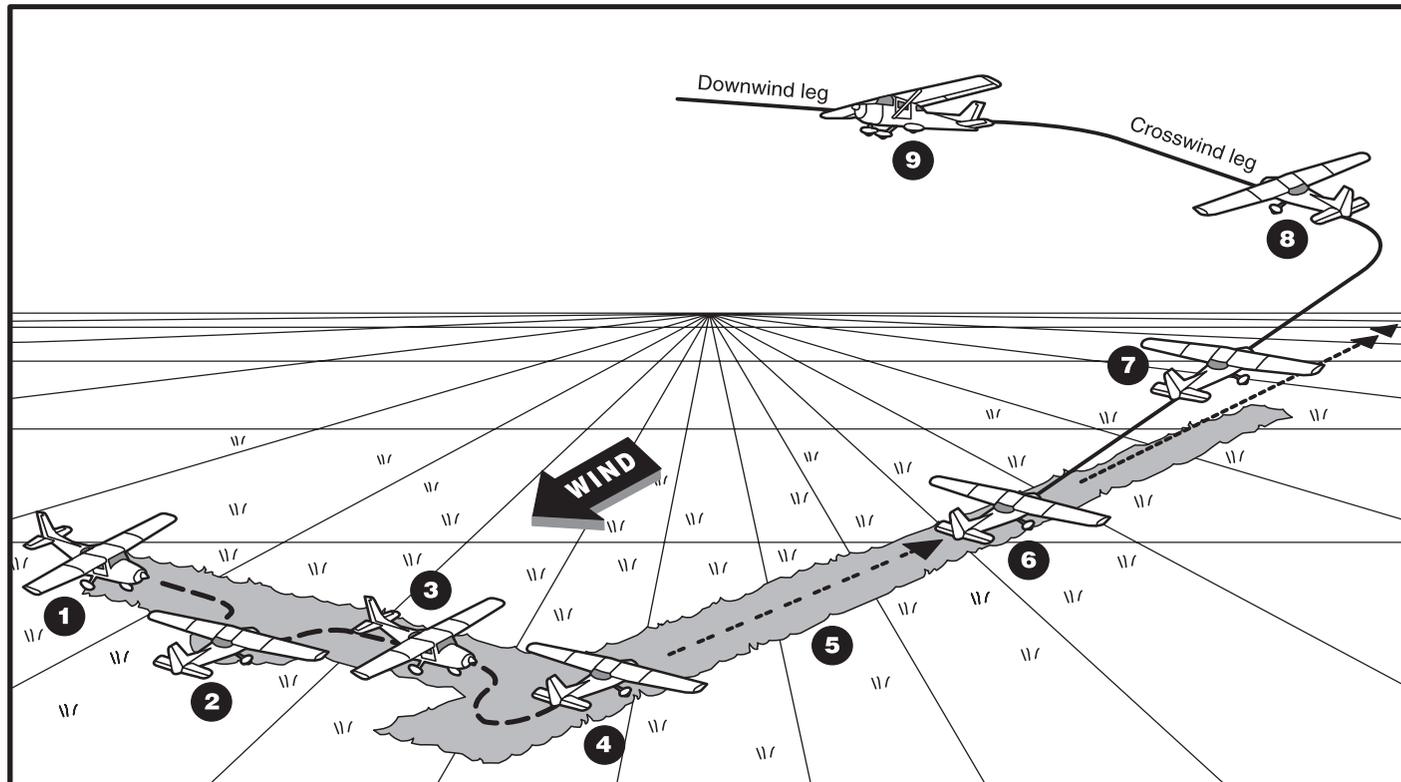
- Complete before-takeoff check (see Page 6)
- Wing flaps 10° for soft-field takeoff



- Know local airport traffic pattern and altitude procedures

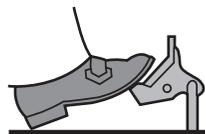
3

- Obtain takeoff and departure clearances, if required
- Look out and check that runway and approaches are all clear



4

- Continue taxi roll without stopping and line up on runway centerline, nose wheel straight
- Select a reference point straight ahead for tracking
- Keep heels on floor, and toes on rudder pedals, not brakes



- Without stopping, apply full throttle smoothly and positively



- During the takeoff ground run, keep weight off the nose wheel with control column held back



5

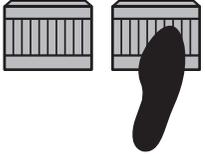
- Keep straight with rudder
- Keep wings level with aileron
- Check RPM for full power
- Check engine instruments are in the green arc
- Relax back pressure on control column as speed builds for earliest possible liftoff

Continued

- Once airborne, stay within 10 feet of the ground and accelerate in ground effect to V_Y
Manufacturer Recommended V_Y _____ knots

6

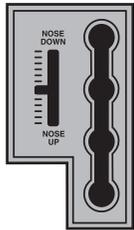
- Climb out of ground effect at V_Y
- Use right rudder to offset torque as required



- Keep right hand on the throttle

7

- Trim off any control pressure



- Maintain wings level with aileron, coordinate with rudder



- After a definite climb is established and the airplane has accelerated to V_Y , retract flaps and adjust attitude to maintain V_Y
- Retract gear after positive rate of climb is established, and a landing cannot be made on remaining runway
- Scan for traffic
- Maintain a straight track over the extended runway centerline

8

- Beyond end of runway and within 300 feet of traffic pattern altitude, make a climbing turn to crosswind leg (bank angle 20° maximum)
- Allow for wind drift to keep a square pattern
- Maintain climb speed and continue to climb to pattern altitude
- Level off at pattern altitude
- Scan for traffic

9

- Within 1/2 to 1 mile from the runway, make a medium turn to downwind leg (bank angle 30° maximum)
- Scan for traffic
- To depart the traffic pattern, either climb straight out from the upwind leg, or turn 45° beyond the departure end of the runway after reaching pattern altitude

Evaluation:

- Position the flight controls for existing wind conditions and to maximize lift as quickly as possible
- Use 10° (soft-field takeoff) flap setting
- Clear the area
- Taxi onto the takeoff surface at a speed consistent with safety and align airplane on runway centerline without stopping while advancing the throttle smoothly to takeoff power
- Establish and maintain pitch attitude that will transfer the weight of the airplane from the wheels to the wings as rapidly as possible
- Lift off and remain in ground effect while accelerating to V_Y , be careful not to settle back to runway
- Establish pitch attitude for V_Y and maintain V_Y during the climb (+10/-5 knots for Private and Sport, ±5 knots for Commercial and CFI)
- Retract landing gear and flaps after a positive rate of climb is established
- Maintain takeoff power to a safe maneuvering altitude
- Maintain directional control and proper wind-drift correction throughout takeoff and climb
- Comply with noise abatement procedures
- Complete the appropriate checklist

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