



# Low-Wing Aircraft **Visualized** **Flight** **Maneuvers** **Manual**

**Fifth Edition**



For Pilots in Training

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AVIATION SUPPLIES & ACADEMICS, INC.  
NEWCASTLE, WASHINGTON

*Low-Wing Aircraft*  
*Visualized Flight Maneuvers Manual*  
Fifth Edition

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None of the material in this book supersedes any operational documents or procedures issued by the Federal Aviation Administration, aircraft and avionics manufacturers, flight schools, or the operators of aircraft.

**ASA-VFM-LO-5**

ISBN 978-1-64425-225-3

Additional format available:  
eBook PDF ISBN 978-1-64425-226-0

Printed in the United States of America

2025 2024 2023 2022 9 8 7 6 5 4 3 2 1

Cover photo:  
Piper Aircraft Inc., Piper Archer TX, Jim Barrett Photography

# 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”)

<b>Area</b>	terrain appropriate for maneuvering, and emergency landing area available
<b>Airspeed</b>	maneuvering speed ( $V_A$ ) or as designated by practical test standards
<b>Altitude</b>	as designated by practical test standards
<b>Clearing turns</b>	clear area for traffic
<b>Technique</b>	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.

# CONTENTS

Aircraft Review.....	1
Airplane Familiarization .....	2
Preflight Operations.....	4
Starting Airplane.....	6
Before-Takeoff Check .....	6a
Taxiing .....	7
Normal Takeoff & Climb .....	8
Crosswind Takeoff & Climb .....	10
Soft-Field Takeoff & Climb .....	12
Short-Field Takeoff & Climb .....	14
Straight and Level Flight.....	16
Shallow & Medium Turns .....	17
Rectangular Course.....	18
S-Turns .....	20
Turns Around a Point .....	21
Eights-On-Pylons.....	22
Maneuvering During Slow Flight.....	24
Power-Off Stalls.....	25
Power-On Stalls .....	26
Accelerated Stalls.....	28
Crossed-Control Stalls.....	29
Elevator Trim Stalls .....	30
Secondary Stalls .....	31
Spins.....	32
Steep Spirals .....	34
Chandelles.....	36
Lazy Eights .....	38
Steep Turns .....	40
Go-Around Procedure .....	41
Traffic Pattern .....	42
Forward Slip.....	44
Normal Approach & Landing .....	45
Crosswind Approach & Landing .....	46
Soft-Field Approach & Landing.....	47
Short-Field Approach & Landing .....	48
Power-Off 180° Accuracy Approach & Landing.....	49

Emergency Descent .....	50
Emergency Approach & Landing.....	51
After-Landing Check.....	52
Energy Management Guide.....	53
Private Checklist.....	55
Sport Checklist .....	56
Commercial Checklist.....	57
Flight Instructor Checklist .....	58
Index.....	59

# AIRCRAFT REVIEW

## Aircraft Model and Type:

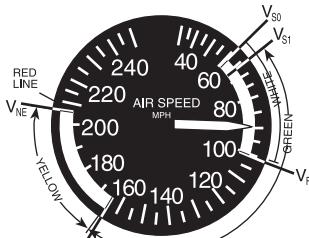
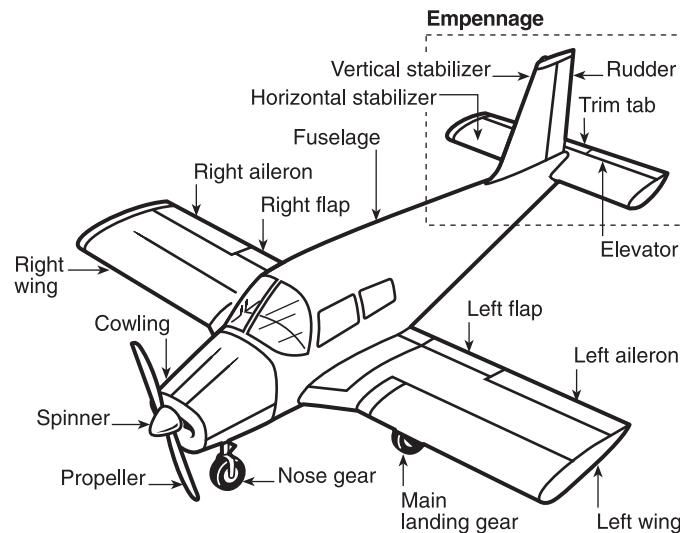
1. What is the normal climb-out speed? \_\_\_\_\_
2. What is the best rate-of-climb speed ( $V_Y$ )? \_\_\_\_\_
3. What is the best angle-of-climb speed ( $V_X$ )? \_\_\_\_\_
4. What is the maximum flaps-down speed ( $V_{FE}$ )? \_\_\_\_\_
5. What is the maximum gear-down speed ( $V_{LE}$ )? \_\_\_\_\_
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? \_\_\_\_\_

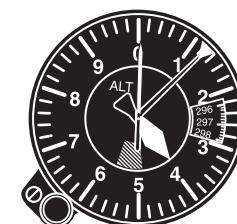
### V Speeds

$V_A$	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

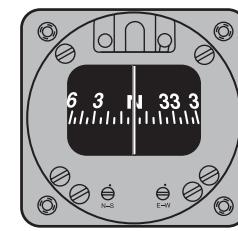
# AIRPLANE FAMILIARIZATION



**Airspeed Indicator**  
Pitot-Static System

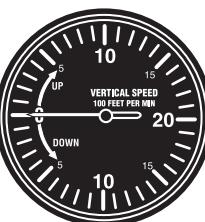
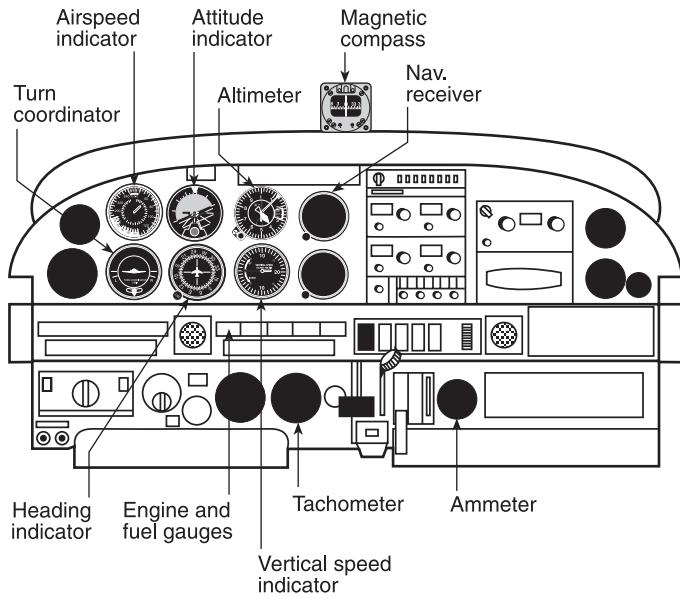


**Altimeter**  
Static System



**Magnetic Compass**

## Flight Instruments



**Vertical Speed Indicator**  
Static System



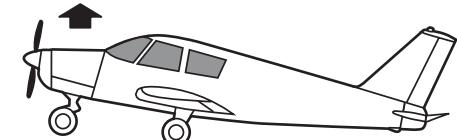
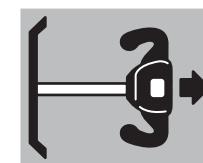
**Turn Coordinator**  
Usually Electric



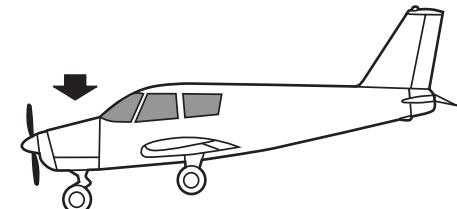
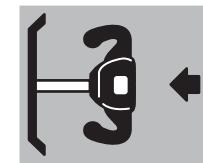
**Attitude Indicator**  
Vacuum System



**Heading Indicator**  
Vacuum System



- When control wheel (yoke) is pulled toward pilot, the nose pitches up.



- When control wheel (yoke) is pushed away from pilot, the nose pitches down.

(continued)

## 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.



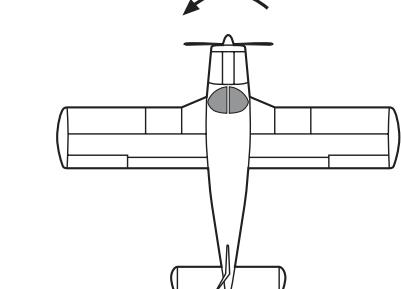
- When control wheel (yoke) is turned to the right, right aileron is raised and airplane rolls to the right.



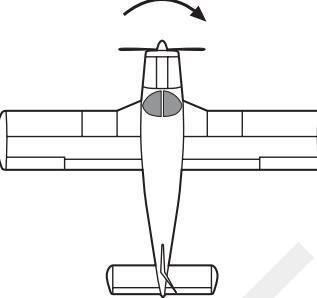
## Rudder

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.



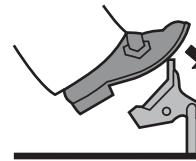
### Rudder pedals

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.



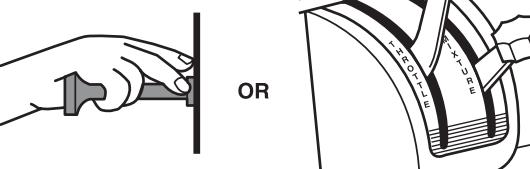
### Brakes

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



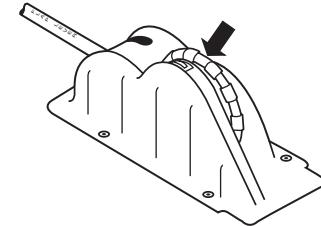
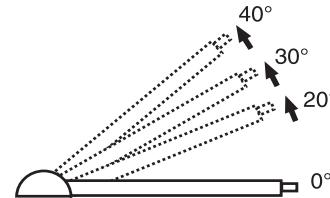
### Throttle

Operate the throttle with the right hand. Hold the throttle so that small changes can be made smoothly.



## Flaps

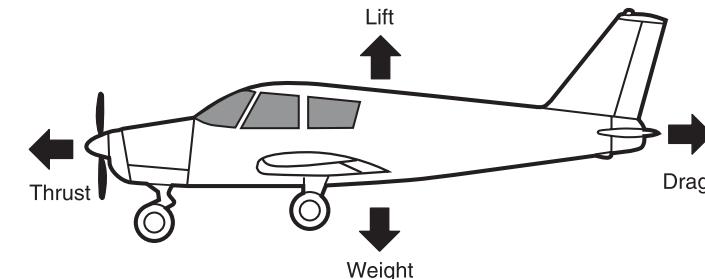
Flaps increase the wing's lift by increasing its area or its camber. Flaps also cause drag because they extend beneath the wing. The lift/drag ratio is determined by the degree of flap extension. Using flaps lowers the wing's stalling speed, and increases the rate of descent without an increase in airspeed.



## 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



# NORMAL TAKEOFF & CLIMB

## (Private, Sport, Commercial, CFI)

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

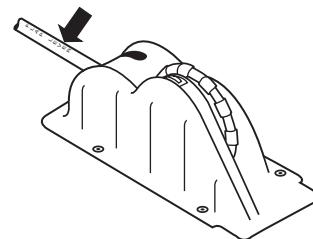
**Task:** Check Manufacturer Recommendations

**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 6a)
- Wing flaps 0° for normal takeoff



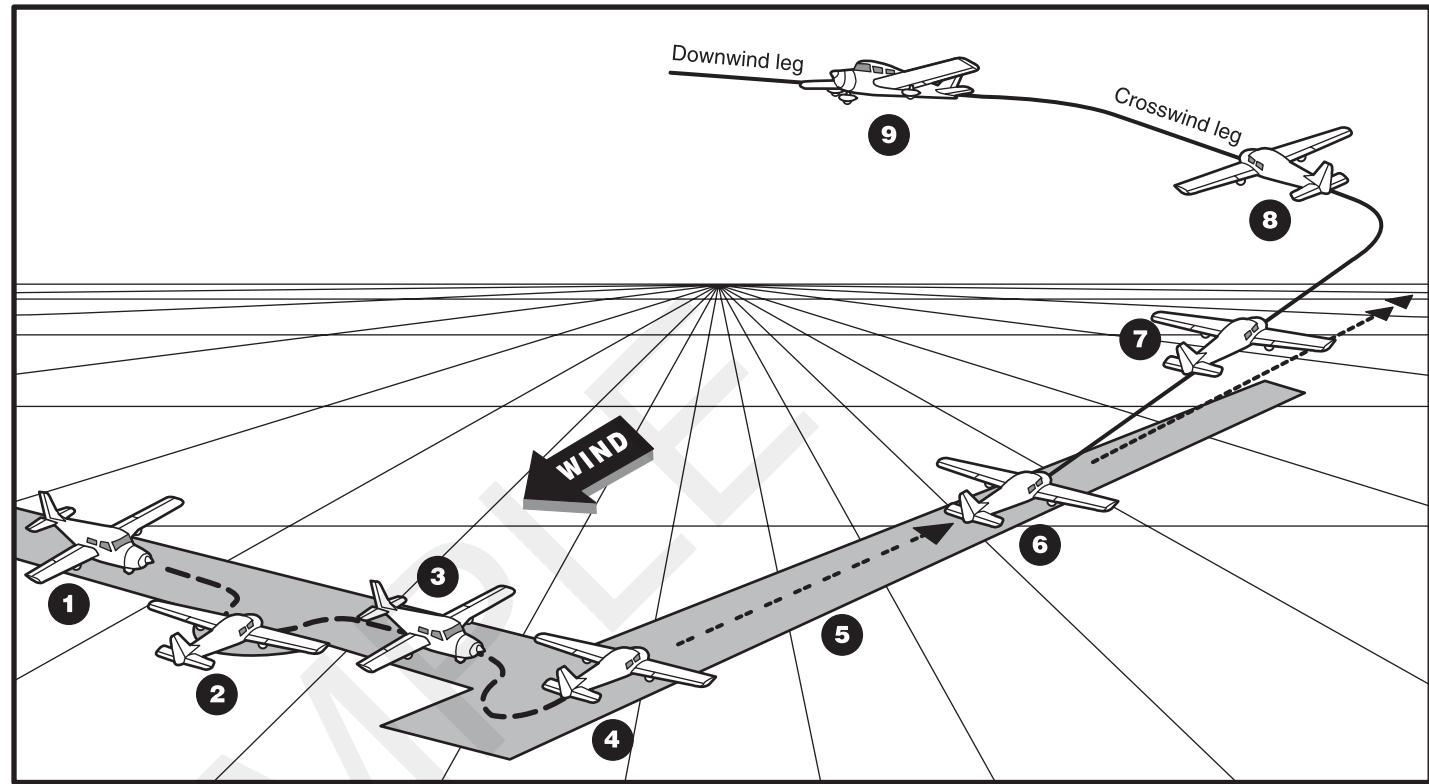
- Know local airport traffic pattern and altitude procedures
- Practice situational awareness and runway incursion avoidance procedures

**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



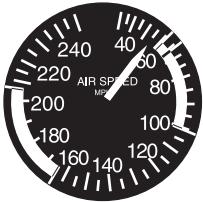
**5**

- 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)

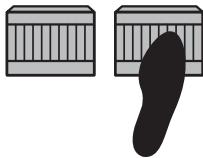
**6**

- Leave runway at lift-off speed



*Manufacturer Recommended lift-off speed \_\_\_\_\_ knots*

- Use right rudder to offset torque as required



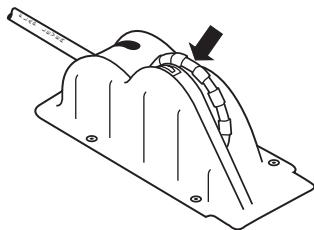
- Keep right hand on the throttle

**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.

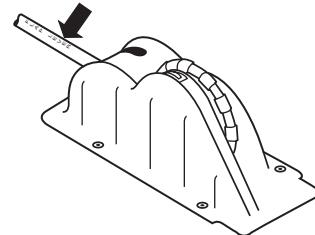
**Task:** Check Manufacturer Recommendations

**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**

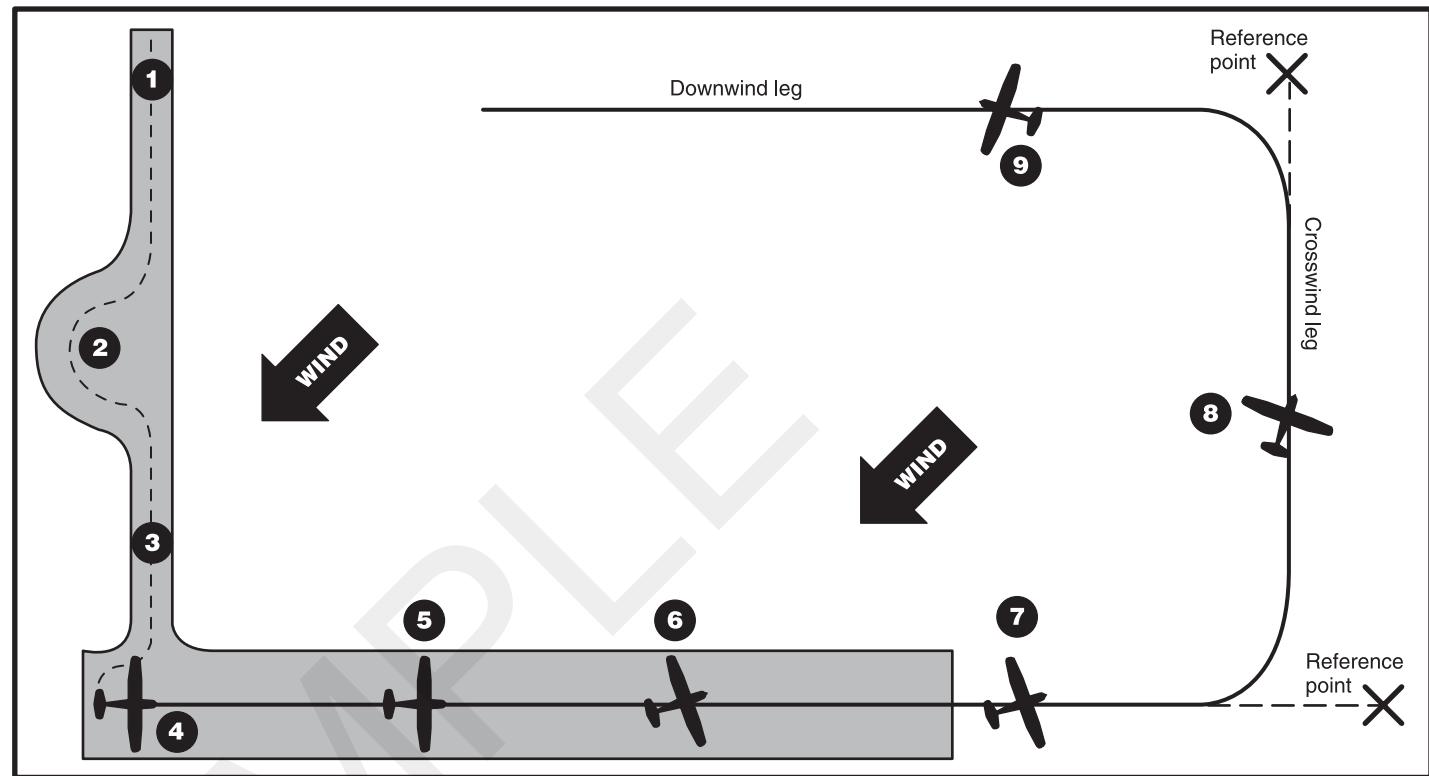
- Complete before-takeoff check (see Page 6a)
- Wing flaps 0° for crosswind takeoff



- 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

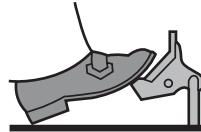


**4**

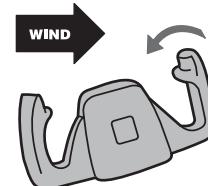
- Line up on runway centerline, nose wheel straight
- Check the windsock



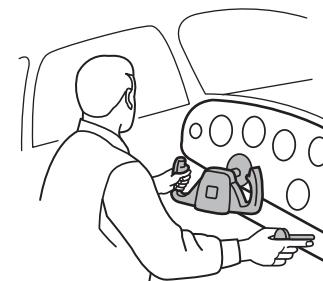
- Select a reference point straight ahead for tracking
- Keep heels on floor, and toes on rudder pedals, not brakes



- Hold full aileron into wind



- Apply full throttle smoothly and positively

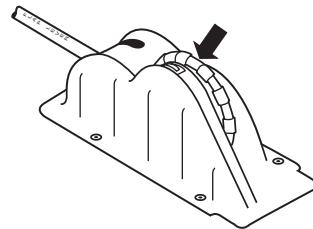


(continued)

**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

- Trim off any control pressure

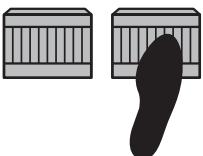
**6**

- 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*

- 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 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

# Low-Wing Aircraft Visualized Flight Maneuvers Manual

Fifth Edition

This comprehensive maneuvers manual is an excellent visual aid for instructors and pilots in training, covering all the flight maneuvers required for Private, Sport, Commercial, and Flight Instructor certification. Each maneuver is depicted in detail according to type of aircraft in which the lesson will take place, states the objective of the task, and lists the FAA Certification Standards required, serving as an effective learning and teaching tool. Fully illustrated with fold-out pages that show and explain each maneuver on a one-page spread so pilots can see and read complete details on what to do, in the proper order, to successfully demonstrate all required flight maneuvers.

Compact format with spiral binding provides easy access to the fold-out pages. The illustrated fold-outs show each maneuver step-by-step, so pilots understand what they should be looking for outside the cockpit window. Contains full descriptions of stalls, slips, performance and ground reference maneuvers as well as short, soft, and crosswind takeoffs and landings. This revised fifth edition adds a new section on energy management. Also included are suggested checklists for everything from preflight to takeoffs and landings, performance, and checkrides, and an easy-to-use index so pilots can quickly refer to any desired task.



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TRANSPORTATION USD \$24.95

ISBN 978-1-64425-225-3



9 781644 252253