CIVIL AIR PATROL
United States Air Force Auxiliary
Cadet Program Directorate

Cessna 172 Maneuvers and Procedures

NOTE

This study guide is designed for the National Flight Academy Ground School. The information contained is based on the C-172-180 horsepower engine. On the flightline, you will be assigned to a Cessna 172, but the model may vary. The differences between the aircraft information taught in ground school and that given in your assigned aircraft's pilot operations handbook will be briefed by your instructor. Your flight instructor is the final authority on the information you will need to know.

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PART 2

Maneuvers and Procedures

C -172

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PURPOSE

The purpose of this publication is to provide standardized procedures for accomplishing the flight maneuvers required during pre-solo, solo practice, and the private pilot flight test.
The procedures in this manual are based on the Cessna l72P aircraft, but may be used in other Cessna 172 models and most other single-engine training aircraft with very few changes.

ALTITUDES

With the exception of the ground reference maneuvers, landings and takeoffs, all maneuvers will be started at such an altitude that recoveries are completed no lower than 1500 feet AGL.

CLEARING TURNS

Clearing turns are shallow to medium banked turns, during which the student and instructor scan the immediate area around their aircraft looking for other air traffic that may conflict with them during the practice maneuver.

Clearing turns must be accomplished before each practice maneuver. A clearing turn will consist of a minimum of 180-degree change in heading. This may be one 180-degree turn in either direction, or two, consecutive 90-degree turns in both directions. The turns should be done at approximately standard rate, but at no more than a 30-degree angle of bank.

During the second 90-degree portion of the turn (last half of a 180-degree turn), the initial power adjustment should be made, and the aircraft should be put into the proper configuration for the practice maneuver. This will allow the maneuver to be accomplished in the shortest possible time after the clearing turn is completed. Remember, however, the primary purpose of a clearing turn is to ensure that your maneuver will not conflict with any other air traffic. The other tasks done during the clearing turns should not compromise vigilance.

LEVEL OFF FROM A CLIMB

While not a practice maneuver (NOTE: no clearing turns are required), the student is required to level-off, from a climb or descent, at a specified altitude, with a reasonable degree of accuracy and proficiency. This procedure will help the student develop this skill quickly, and perform level-offs with minimum altitude deviation, and a minimum of power and trim readjustments.

1. PITCH: When aircraft is approximately 10% of the rate of climb (e.g. 10% of 500 ft./min. is 50 feet) below the target altitude, slowly lower the pitch altitude to the level, cruise flight attitude. As the aircraft accelerates, apply more forward elevator pressure to maintain the target altitude.

2. POWER: As the airspeed increases near cruise airspeed, reduce throttle to the cruise power setting.

NOTE

Reduce the throttle early if required to keep the engine RPM within limits. Right rudder pressure will have to be decreased to maintain coordinated flight as the airspeed increases, and as power is reduced.

3. TRIM: Use elevator trim to reduce the forward elevator pressure.

NOTE

Trim may be used as the aircraft accelerates to relieve heavy, forward elevator pressures, but avoid flying the aircraft with trim. Trimming is the last step, as it is affected by any changes made by the first two.

LEVEL FLIGHT TO A CLIMB

This procedure follows the same basic steps as the previous maneuver, and provides the student a simple and efficient means of beginning a constant airspeed climb.

1. PITCH: Increase pitch to an attitude that should give a full-power climb at V_Y

2. POWER: After the airspeed has decreased to approximately 5 knots above V_Y increase throttle to full power.

NOTE

Increase right rudder pressure to maintain coordination at the lower airspeed and increased power.

3. TRIM: Use elevator trim to relieve any elevator control pressures and maintain V_Y

LEVEL FLIGHT TO A DECENT

Similar to the previous maneuvers, this procedure provides the student with a simple method to transition from level flight to a constant airspeed decent.

1. PlTCH: Reduce pitch to an altitude that will provide 500 – 700 ft/min rate of decent. (NOTE: This will only require a 5 -10 degree pitch change).

2. POWER: After the aircraft has accelerated 5 - 10 knots (approx. 115 KlAS for a C-I72), reduce the power by approximately 200 - 300 RPM to maintain this new speed.

3. TRIM: Use elevator trim to relieve any elevator control pressure and maintain a constant airspeed.

LEVEL-OFF FROM A DECENT

This procedure provides the student with a simple and accurate method to level-off from a decent, at a target altitude, with a minimum of altitude deviation, or power and trim readjustment.

1. PITCH: When the aircraft is approximately 10% of the decent rate (e.g. 10% of 500 ft/min is 50 feet) above the target altitude, increase the pitch to the level cruise flight attitude.

2. POWER: As the airspeed decreases toward cruise airspeed, increase the throttle to cruise power.

3. TRIM: Adjust the elevator trim for level flight at cruise airspeed.

NOTE

All of the above maneuvers require a change in rudder control inputs in order to maintain proper coordination, as airspeed and/or power is changed.

STEEP TURNS

The purpose of this practice maneuver is to develop smoothness coordination, orientation, division of attention, and proper altitude and airspeed control while executing high performance turns. Through this maneuver the student will also learn the effect of bank angle on the total lift of the aircraft.

1. CLEARING TURN(S)

   At the 90-degree point

   (a) Slowly reduce power to approximately 2200 - 2300 RPM.

   NOTE

   The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

   (b) Maintain altitude by increasing elevator back pressure and use elevator trim as required

2. Maintain an airspeed at or below maneuvering speed (V_A)

3. Use coordinated aileron and rudder to establish a bank angle of 45°. (+/- 5 degrees)

4. After approximately 30 degrees of heading change, increase elevator back pressure and increase power to approximately 2400 RPM.

5. Continue turn for two full revolutions (360 degrees), left and right.

6. Approximately 25 degrees (or one half the angle of bank) before reaching the desired heading, use coordinated aileron and rudder to smoothly roll out of the bank, while simultaneously pushing the nose down and reducing power back to 2200-2300RPM. This will keep the aircraft from entering a climb.

   NOTE

   The best way to correct for small climbs or descents during this maneuver is to vary the bank angle by small amounts (no more than 5 degrees). If descending, decreasing the bank angle will usually result in an overcorrection. Excessive elevator back pressure while trying to gain altitude during the steep turn increases the loading on the aircraft, and can lead to a high descent rate or possibly an accelerated stall.

POWER-ON STALL

The purpose of the power-on stall is to demonstrate the effect of an excessive angle of attack of the aircraft with the engine developing medium power, to teach stall recognition and avoidance, and to teach proper stall recovery techniques. The power-on stall is used to prepare the student for demonstration and recovery of takeoff/departure stalls.

1. CLEARING TURN(S)

   At the 90-degree point:

   a) Apply carburetor heat

   b) Slowly reduce power to approximately 1500 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

   c) Maintain altitude by increasing elevator back pressure

2. When the airspeed reaches approximately 60 KlAS, increase power to 1900 to 2200 RPM and turn off carburetor heat.

3. Increase the pitch to an attitude that is slightly higher than the normal climb attitude (if this maneuver is to be demonstrated as a turning stall, initiate the turn at this point).

4. Maintain the pitch attitude by increasing elevator back pressure until the first sign that a stall is imminent (imminent stall recovery) or until the stall occurs (full stall recovery).

NOTE

As airspeed decreases, it is necessary to increase right rudder pressure to maintain proper coordination.

RECOVERY

a) Decrease elevator back pressure. Level wings with coordinated ailerons and rudder. Apply full power.

b) When control of the aircraft is reestablished and airspeed begins to increase, smoothly fly the airplane to attain V_Y speed.

NOTE

Do not try to establish the best rate of climb attitude too abruptly, as a secondary stall may occur.

POWER-OFF STALL

The purpose of this maneuver is to teach the student stall recognition and avoidance, and proper recovery techniques for a stall occurring during the approach and landing phase of the flight. Simulating a traffic pattern and landing approach with excessive elevator back pressure, this maneuver is done at altitude, but practiced as if the stall occurs only several hundred feet above the ground, requiring the recovery to be accomplished without losing more than 200 feet of altitude.

1. CLEARING TURN(S)

   At the 90-degree point:

   a) Apply carburetor heat.

   b) Slowly reduce power to approximately 1700 RPM.

   NOTE

   The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

   c) Maintain altitude by increasing elevator back pressure.

2. When V_{FE} minus 5 KIAS is attained, extend 10 degrees of flaps, and establish and maintain 70 KIAS.

   NOTE

   Do not start a descent from altitude until 70 KIAS is established. Airspeed and altitude control is as important in high-altitude practice as it is in the traffic pattern.

3. After descending 100 feet:
   a) Reduce power to approximately 1300 RPM, simulating the power reduction on the base leg of the traffic pattern.
   b) Extend flaps an additional 10 degrees.
   c) Maintain 65 KIAS

4. After descending another 100 feet:
   a) Reduce power to approximately 1100 RPM, simulating the power reduction on final approach.
   b) Extend full flaps.
   c) Maintain 60 KIAS

2. Reduce power to idle and slowly increase the pitch attitude until the first sign that a stall is imminent (imminent stall recovery) or until the stall occurs (full stall recovery).

3. RECOVERY
    a) Decrease elevator back pressure. - Level wings with coordinated ailerons and rudder. Full power (Carburetor Heat - OFF). - Retract flaps to 20 degrees.
    b) Establish a normal climb attitude and trim.
    c) After attaining a positive rate of climb, 55 KIAS, and gaining 150 feet of altitude, retract flaps to 10 degrees.
    d) After attaining 60KIAS and gaining another 100 feet of altitude, fully retract the flaps.

NOTE

In steps c. and d., either of the altitude/speed requirements have not been met, then delay flap retraction until both of the elements are attained.

    e) Establish a normal climb at V_Y.

NOTE

Once recovery is affected, the pitch should not vary from the normal climb attitude. As the flaps are retracted, the aircraft will tend to pitch down. This should be counteracted by applying the correct amount of elevator back pressure, and retrimming after each configuration change.

NOTE

The procedure for a go-around or balked landing recovery is identical to the approach/landing stall recovery, except stall recovery is not required.

MINIMUM CONTROLLABLE AIRSPEED (MCA)

Minimum Controllable Airspeed (MCA) demonstrates the changes in the handling characteristics of the aircraft at its minimum flight speed. Through practice of this maneuver, the student will learn precise airspeed and altitude control, the effect of high power at low airspeeds, and techniques for operating the aircraft in the area of reverse command ("behind the power curve").

1. CLEARING TURN(S)

   At the 90-degree point:

   a) Apply carburetor heat.

   b) Slowly reduce power to approximately 1700 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

   c) Maintain altitude by increasing elevator back pressure.

2. When V_{FE} minus 5 KIAS is attained, extend 10 degrees of flaps, and establish and maintain 60 KIAS.

NOTE

Adjust power as necessary to maintain altitude while holding the desired airspeed.

3. Extend flaps to 20 degrees, and maintain 50 KIAS.

4. Extend flaps to 30 degrees and maintain 40 KlAS.

NOTE

Re-trim the aircraft after every power or configuration change.

NOTE

During low airspeed/high power configurations a large amount of right rudder pressure will be required to maintain proper coordination.

5. RECOVERY
   a) Apply full power (turn carburetor heat off). - Retract flaps to 20 degrees.

   b) Retract flaps in 10-degree increments as airspeed increases. - Maintain altitude and heading.

   c) After cruise airspeed is attained, reduce power to cruise setting.

TRAFFIC PATTERN SEQUENCE

This procedure is provided to standardize the traffic pattern procedures used in primary flight training, and will allow the flight training pattern work to operate well with a wide variety of other air traffic in the airport environment.

DOWNWIND

1. Set power to 2100 RPM (Lower limit of normal RPM range). This will produce approximately 90 KIAS in level flight.

2. At the mid field, apply carburetor heat.

3. Abeam the intended touchdown point, reduce power to approximately 1700 RPM.

NOTE

When power is reduced, it is necessary to increase elevator back pressure to maintain altitude. The descent from pattern altitude should not begin until the initial approach speed is reached.

4. Extend 10 degrees of flaps when airspeed is at the top of the white arc.

5. Maintain 75 KIAS and use elevator trim as necessary.

NOTE

Do not descend from pattern altitude until 75 KIAS is reached.

6. Begin the turn to base leg when the runway threshold is 45 degrees behind the aircraft and the traffic ahead has passed by on final. If it is necessary to extend the downwind leg because of traffic, delay the next power reduction and the addition of flaps.

BASE

7. Reduce power to 1200 - 1400 RPM.

8. Extend flaps to 20 degrees.

9. Maintain 70 KlAS and trim as necessary.

FINAL

10. Reduce power as required.

11. Extend full flaps when landing is assured.

12. Maintain 65 KlAS (Short/soft field landings will require a different approach speed).

13. Reduce power to idle as appropriate. Touchdown should occur approximately 500 feet beyond the runway threshold.

NOTE

Unless turbulence or a strong crosswind dictates the need for touchdown at a slightly higher airspeed, touchdown should occur with the stall horn on, in the classic nose high attitude. This will minimize the possibility of directional control problems occurring after touchdown. Landings should be accomplished with 0-20 degrees of flaps unless special considerations dictate otherwise.

NOTE

For a short-field approach, establish 65 KIAS with 20 degrees of flaps on base. When the field is made, slow to 60 KIAS and apply full flaps.

NOTE

For a soft-field approach, the same procedures for the short field approach are used, except 1100 - 1200 RPM are maintained throughout final approach, flare, touchdown, and roll out. This will help ensure a landing with minimum speed and sink rate. The nose wheel should be held up as long as possible, and a minimum of braking should be used.

GO-AROUND/BALKED LANDING

Sometimes during traffic pattern work and landings, you will find yourself poorly positioned and will have to discontinue an approach for reasons of safety and execute a go-around. Although an approach or landing may be aborted at any point, the sooner a poor approach/landing condition is recognized and the go-around started, the safer it will be. You should not wait until the last second to make a decision and you should not try to salvage a bad approach or landing. The pilot of the aircraft is responsible for executing the go-around when a dangerous condition is encountered.

From Final or Landing Phase:

1. Throttle - Full in
2. Carburetor Heat – COLD
3. Flaps - retract to 20 degrees as soon as practical after advancing power
4. Airspeed 78 KIAS
5. Sidestep same direction as traffic pattern
6. At a safe attitude and airspeed, retract flaps - slowly

NOTE

If it is necessary to discontinue the landing pattern, follow the local procedures for leaving the pattern.

SHORT-FIELD TAKEOFF

1. Lower flaps to 10 degrees.
2. Line up on runway centerline and apply brakes. Start takeoff roll from as close to the end of the runway as possible.
3. Put elevator in the neutral position

NOTE

You may find this position by visually assuring that the elevator is in line with the horizontal stabilizer. DO NOT use forward elevator pressure in an attempt to hold the airplane on the runway during the takeoff roll.

4. Apply full power and verify that full power is being developed.
5. Release brakes.

6. Rotate at 55 KIAS and maintain 57 KIAS until obstacle is cleared.

7. After the obstacle is cleared, assume a normal climb attitude by climbing at V_X.

8. After airspeed reaches 65 KIAS, and altitude is greater than 150 feet AGL, retract the flaps then maintain 76 KIAS (V_Y).

SOFT -FIELD TAKEOFF

1. Lower flaps to 10 degrees and apply full back elevator.

2. After taxiing onto runway, apply full power without stopping on runway.

NOTE

Some elevator backpressure will have to be released to prevent striking the tail on the runway. Keep only enough back elevator to keep the nosewheel just clear of the runway surface. It will take considerable rudder input to maintain a straight takeoff roll without the nosewheel in contact with the runway.

3. Liftoff will occur at or near Vs_1

4. Immediately after liftoff, begin to gradually lower the pitch to the normal climb attitude.

NOTE

If there is an obstacle, lower the pitch attitude so that 62 KIAS (V_X) is maintained until the obstacle is cleared before accelerating to 76 KlAS (V_Y).

5. After airspeed reaches 65 KIAS, and altitude is greater than 150 feet AGL, retract the flaps then maintain 76 KIAS (V_Y).

NOTE

It is important to immediately reduce the pitch attitude after liftoff to prevent a potential takeoff/departure stall as the aircraft climbs out of ground effect. However the pitch should not be reduced so rapidly that the aircraft settles back onto the ground.

GROUND REFERENCE MANEUVERS

Ground reference maneuvers are designed to develop the student's ability to control the airplane, and recognize and correct for the effect of wind while dividing attention among other matters.

1. CLEARING TURN(S)

2. Enter the maneuver at an altitude of 600-1000 feet AGL and an airspeed less than maneuvering speed (V_A)

3. ALL GROUND REFERENCE MANEUVERS SHALL BE ENTERED WHILE FLYING DOWNWIND.

4. Use 45 - 50 degree banked turns, maximum, at the points of highest ground speed.

5. The maneuvers S-Turns and Turns Around a Point