PRIVATE PILOT

IX. AREA OF OPERATION: BASIC INSTRUMENT MANEUVERS

C. TASK: CONSTANT AIRSPEED DESCENTS

OBJECTIVE

To determine that the applicant:

1. Exhibits knowledge of the elements related to attitude instrument flying during constant airspeed descents.
2. Establishes the descent configuration specified by the examiner.
3. Transitions to the descent pitch attitude and power setting on an assigned heading using proper instrument cross-check and interpretation, and coordination control application.
4. Demonstrates descents solely by reference to instruments at a constant airspeed to specific altitudes in straight flight and turns.
5. Levels off at the assigned altitude and maintains that altitude +/-200 feet (60 meters), heading +/-20°, and airspeed +/-10 knots.

ELEMENTS

1. With the integrated method of flight instruction, both outside references and flight instruments are used to maintain desired airplane performance.
2. The constant airspeed descent is one of the four fundamental flight maneuvers (straight-and-level flight, turns, climbs and descents – the basic ingredients for all flight maneuvers).
3. When an airplane enters a descent, it changes its flightpath from level flight to an inclined plane.
4. Descents can be made with a wide variety of airspeed, pitch attitude and power combinations.
5. Partial power descent – used for cruise and normal descent.
    a. A nose-low low-power descent condition.
    b. Target descent rate is usually about 500 feet per minute.
    c. Airspeed can range from slow pattern speed to fast cruise.
6. Descent at minimum safe airspeed – used for clearing obstacles on approach to landing.
    a. A nose-high power-assisted descent condition.
    b. Descent rate requirements vary with obstacles and runway lengths.
    c. Excessive power may be needed below V_{SO} (region of reversed command).
7. Glides – used for power-off accuracy landings and forced landings after engine failure.
    a. Forward motion is maintained by gravity pulling the airplane along an inclined path.
    b. Descent rate is controlled by the pilot balancing the forces of gravity and lift.
    c. The absence of propeller slipstream reduces the effectiveness of control surfaces.
    d. The lift-over-drag (L/D) ratio determines the glide ratio (altitude lost over horizontal distance covered).
        i. With a tailwind, groundspeed and horizontal distance covered increase.
        ii. With a headwind, groundspeed and horizontal distance covered decrease.
    e. The heavier the weight, the higher the airspeed must be for the same L/D (the horizontal distance covered will not change).
    f. The best glide speed (V_G) is at an angle producing the highest lift-to-drag ratio (L/D_{MAX}).
    g. The pilot should never attempt to “stretch” a glide by applying back-elevator pressure and reducing the airspeed below the airplane’s recommended V_G.
8. A straight descent is entered by reducing power until the recommended descent speed is attained, then gently relaxing back-elevator pressure to lower the nose of the airplane relative to the horizon.
9. If establishing a descending turn:
    a. Either the pitch angle or airspeed must be reduced since the bank angle creates a horizontal component of lift by reducing the vertical component of lift.
    b. The degree of bank should be shallow and constant. When the bank angle is too large, exceeding steep descent angles and airspeeds result.
    c. Maintain a coordinated turn at constant airspeed and rate of turn.
    d. Because of the lower airspeed and power, aileron drag (adverse yaw) will be less prominent than in straight-and-level flight - less correcting rudder pressure will be needed.
10. After the descent is established at the desired airspeed, trim out control pressures.
11. For descents solely by reference to instruments:
    a. The AI is the control instrument (the center of the scan)
        i. The AI gives a direct indication of pitch and bank attitude.
        ii. The pilot’s instrument scan radiates out from the AI.

   b. Lower the miniature aircraft to the appropriate nose low indication after slowing to the descent airspeed by reducing power.
      i. Allow the airspeed to stabilize for the selected attitude and power setting.
      ii. If the airspeed is low or high, make a small pitch correction nose-down or nose-up.
   c. The altimeter, vertical speed indicator (VSI) and airspeed indicator (ASI) are the performance instruments for pitch:
      i. The altimeter gives an indirect indication of pitch attitude (assuming constant power).
      ii. The VSI gives an indirect indication of pitch attitude. It is a trend and rate instrument. The larger the VSI deviation from the desired descent rate, the larger the correction. As the needle returns to the desired descent rate, relax the correction pressure.
      iii. The ASI gives an indirect indication of pitch attitude. The larger the ASI difference from the desired descent airspeed, the larger the correction. As the needle returns to the desired descent airspeed, relax the correction pressure
      iv. The pilot's instrument scan for pitch should move from the control instrument (AI) to one of the performance instruments then back to the control instrument (AI).
   d. The heading indicator (HI) and the turn coordinator (TC) are the performance instruments for bank:
      i. The HI gives an indirect indication of bank attitude. To correct, use a bank angle no larger than the number of degrees to be turned.
      ii. The TC gives an indirect indication of bank attitude. With either a ball or miniature airplane deflection, the airplane is in a turn.
      iii. The pilot's instrument scan for bank should move from the control instrument (AI) to one of the performance instruments then back to the control instrument (AI).

12. To return to straight-and-level flight, lead the level-off by 10% of the descent rate (50' for 500 FPM).
13. Raise the nose gradually to maintain airspeed and prevent altitude loss.
14. Set cruise power to attain cruise airspeed.
15. After allowing time for engine temperature to stabilize, adjust the mixture control.
16. After straight-and-level flight is established at the desired airspeed, trim out control pressures.
17. For climbs by outside references, the pilot's attention should be outside the cockpit 90% of the time - no more than 10% of the pilot's attention should be inside the cockpit (instrument cross-checks).

COMMON ERRORS

a. Failure to adequately clear the area.
b. Inadequate back-elevator control during glide entry resulting in too steep a glide.
c. Failure to slow the airplane to approximate glide speed prior to lowering pitch attitude.
d. Attempting to establish / maintain a normal glide solely by reference to instruments.
e. "Fixation," "omission," and "emphasis" errors during instrument cross-check.
f. Improper instrument interpretation.
g. Inability to sense changes in airspeed through sound and feel.
h. Inability to stabilize the glide (chasing the ASI).
i. Attempting to "stretch" the glide by applying back-elevator pressure.
j. Skidding or slipping during gliding turns due to inadequate appreciation of the difference in rudder action as opposed to turns with power.
k. Failure to lower pitch attitude during gliding turn entry resulting in a decrease in airspeed.
l. Excessive rudder pressure during recovery from gliding turns.
m. Inadequate pitch control during recovery from straight glides.
n. "Ground shyness" – resulting in cross-controlling during gliding turns near the ground.
o. Failure to maintain constant bank angle during gliding turns.
p. Faulty trim procedure.

REFERENCES

1. FAA-H-8083-3A, Airplane Flying Handbook, Chapter 3.
2. FAA-H-8083-15, Instrument Flying Handbook, Chapter 5.