PRIVATE PILOT

IX. AREA OF OPERATION: BASIC INSTRUMENT MANEUVERS

A. TASK: STRAIGHT-AND-LEVEL FLIGHT

OBJECTIVE

To determine that the applicant:

1. Exhibits knowledge of the elements related to attitude instrument flying during straight-and-level flight.
2. Maintains straight-and-level flight solely by reference to instruments using proper instrument cross-check and interpretation, and coordinated control application.
3. Maintains 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. Straight-and-level flight is one of the four fundamental flight maneuvers (straight-and-level flight, turns, climbs and descents – the basic ingredients for all flight maneuvers).
3. Straight-and-level flight is flight in which a constant heading and altitude are maintained.
4. Immediate corrections are made for slight turns, descents and climbs.
5. Level flight is accomplished by fixing the distance between the dash or cowl and the horizon.
    a. Different power settings vary the angles of attack and require different reference distances.
    b. With the reference distance set for a given power setting, trim out control forces.
    c. For level flight by outside references, the reference distance should be cross-checked occasionally with the attitude indicator (AI) and altimeter.
    d. For level flight solely by reference to instruments:
        i. The AI is the control instrument (the center of the scan)
            1. The AI gives a direct indication of pitch attitude.
            2. The pilot's instrument scan radiates out from the AI.
        ii. Restrict the displacement of the AI horizon bar to +/- one full bar width.
            1. For errors less than 100', use a half-bar-width correction.
            2. For errors in excess of 100' use an initial full-bar-width correction.
        iii. The altimeter, vertical speed indicator (VSI) and airspeed indicator (ASI) are the performance instruments for pitch:
            1. The altimeter gives an indirect indication of pitch attitude (assuming constant power). For altitude gain, lower nose, for altitude loss, raise nose.
            2. The VSI gives an indirect indication of pitch attitude. It is a trend and rate instrument. The larger the VSI deviation from zero, the larger the correction. As the needle returns to zero, relax the correction pressure.
            3. The ASI gives an indirect indication of pitch attitude. The larger the ASI difference from normal cruise, the larger the correction. As the needle returns to the desired altitude, relax the correction pressure
            4. 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).
6. Straight flight is accomplished by fixing the distance between the wingtips and the horizon.
    a. Both wingtips should be equidistant above or below the horizon.
    b. Adjustments should be made with the ailerons.
    c. Anytime the wings are banked in coordinated flight, even slightly, the airplane will turn.
    d. For straight flight by outside references, the reference distances should be cross-checked occasionally with the heading indicator.
    e. For straight flight solely by reference to instruments:
        i. The AI is the control instrument (the center of the scan)
            1. The AI shows a change in bank angle directly and instantly.
            2. The pilot's instrument scan radiates out from the AI.
        ii. To detect small banks, use the scale pointer and 0° pointer on the top of the AI for bank indication (instead of the artificial horizon bar).

iii. The heading indicator (HI) and the turn coordinator (TC) are the performance instruments for bank:
   1. 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.
   2. The TC gives an indirect indication of bank attitude. With either a ball or miniature airplane deflection, the airplane is in a turn. Return to straight flight by smooth coordinated aileron and rudder pressure.
   3. 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).

7. Straight-and-level flight requires almost no application of control pressures if properly trimmed.
8. For straight and level flight 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. Attempting to use improper reference points on the airplane to establish attitude.
b. Forgetting the location of preselected reference points of subsequent flights.
c. Attempting to establish or correct airplane attitude using flight instruments rather than outside visual references.
d. Attempting to maintain direction using only rudder control.
e. Habitually flying with one wing low.
f. "Fixation," "omission," and "emphasis" errors during instrument cross-check.
g. "Chasing" the flight instruments rather than adhering to the principles of attitude flying.
h. Improper instrument interpretation.
i. Too tight a grip on the flight controls resulting in overcontrol and lack of feel.
j. Pushing of pulling on the flight controls rather than exerting pressure against the airstream.
k. Improper scanning and/or devoting insufficient time to outside visual references (head in the cockpit).
l. Fixation on the nose (pitch attitude) reference point.
m. Unnecessary or inappropriate control inputs.
n. Failure to establish proper pitch, bank or power adjustments during altitude, heading, or airspeed corrections.
o. Failure to make timely and measured control inputs when deviations from straight-and-level flight are detected.
p. Inadequate attention to sensory inputs in developing feel for the airplane.
q. Faulty trim procedure.

REFERENCES

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