PRIVATE PILOT

X. AREA OF OPERATION: EMERGENCY OPERATIONS

B. TASK: SYSTEMS AND EQUIPMENT MALFUNCTIONS

OBJECTIVE

To determine that the applicant:

1. Exhibits knowledge of the elements related to system and equipment malfunctions appropriate to the airplane provided for the practical test.
2. Analyzes the situation and takes appropriate action for simulated emergencies appropriate to the airplane provided for the practical test for at least three (3) of the following –
    a. Partial or complete power loss.
    b. Engine roughness or overheat.
    c. Carburetor or induction icing.
    d. Loss of oil pressure.
    e. Fuel starvation.
    f. Electrical malfunction.
    g. Vacuum / pressure, and associated flight instruments malfunction.
    h. Pitot / static.
    i. Landing gear or flap malfunction
    j. Inoperative trim.
    k. Inadvertent door or window opening.
    l. Structural icing.
    m. Smoke / fire / engine compartment fire.
    n. Any other emergency appropriate to the airplane.
3. Follows the appropriate checklist or procedure.

ELEMENTS

1. Have available the manufacturers' recommended checklist for any standard emergency procedure.
2. Be able to access any emergency checklist quickly.
3. Be familiar with the reasons behind each step in any emergency checklist.
4. Types of emergency landings:
    a. Forced landing: Immediate landing required - on or off the airport.
    b. Precautionary landing: Premeditated - further flight is possible but not advisable.
    c. Ditching: Forced or precautionary landing in water.
5. Psychological hazards:
    a. Reluctance to accept the emergency situation – paralysis by analysis.
    b. Desire to save the airplane - protect assets in the order of skin, tin, then ticket.
    c. Undue concern about getting hurt – survival records favor pilots who maintain composure.
6. Basic safety concepts:
    a. Keep vital structure (cockpit and cabin) intact by using dispensable structure (wings, landing gear, bottom fuselage) to absorb energy during an emergency landing. Also consider using vegetation, trees or even manmade structures to absorb energy – interestingly, cultivated fields with dense crops are almost as effective as emergency arresting devices on runways.
    b. Kinetic energy = $\frac{1}{2}mV^2$, so doubling the groundspeed results in quadrupling the impact energy. Touchdown should be made at the lowest possible *controllable* airspeed. This usually requires the use of full flaps if available. For landing gear, see the AFM / POH.
    c. Avoid excessive nose-low pitch attitude which risks sticking the nose in the ground.
    d. Avoid a high sink rate – such a landing on a hard surface increases the risk of injury.
    e. A well-executed crash landing in poor terrain can be less hazardous than an uncontrolled touchdown on an established field.
    f. It is generally advisable to turn off the electrical system, the engine and the fuel just before touchdown.
    g. Approach governed by 1) wind direction and velocity, 2) dimensions and slope of the selected field, and 3) obstacles in the final approach path.

   h. If contact with tree trunks is unavoidable when on the ground, involve both wings simultaneously by directing the airplane between two properly spaced trees.
   i. When ditching, keep retractable gear up unless the AFM / POH advises otherwise.
   j. In an engine failure after takeoff, it is safer to land directly ahead or slightly to the side.
7. In-flight fires. Treat the fire and land as soon as possible:
   a. Engine fire: Shut off fuel and follow the specific AFM / POH checklist.
   b. Electrical fire: Check and isolate circuit breakers.
   c. Cabin fire: Identify and shut down faulty system. Use extinguisher. Open air vents.
8. Flight control malfunction / failure:
   a. Total flap failure: Execute the no-flap approach and landing per the AFM / POH keeping in mind the increased airspeed and runway required.
   b. Asymmetric (split) flap: Retract functioning flap if possible and execute the no-flap approach and landing. If flaps are set in the split configuration, oppose the drag from the extended flap with opposite rudder and the roll with opposite aileron.
   c. Loss of up-elevator control: Apply nose-up trim, push the control yoke forward to maintain attitude and release to flare for landing.
   d. Loss of down-elevator control: Apply nose-down trim, pull the control yoke aft to maintain attitude and increase to flare for landing.
   e. Landing gear malfunction: Follow the specific AFM / POH checklist. If still retracted:
      i. Dive to V_{NE} (smooth air only) and execute rapid pull-up (within aircraft limits).
      ii. Induce rapid yawing (below V_A) with aggressive alternating rudder pressures.
      iii. Select an airport with crash / foam / rescue facilities. Have them standing by.
      iv. Consider a total gear-up landing instead of a partial gear-up landing.
      v. Land as slow as possible.
9. Systems malfunctions:
   a. Electrical system failure: Follow the specific AFM / POH checklist. Shed non-essential loads, especially high-ampere components. Land at the nearest suitable airport as soon as practicable.
   b. Pitot-static system failure: Blockages affect ASI, VSI and Altimeter. If readings are suspect, use the alternate static source.
   c. Abnormal engine instrument indications: Refer to AFM / POH for specifics.
   d. Door opening in flight: Concentrate on flying. Land and close it on the ground.
   e. Inadvertent VFR flight into IMC: Maintain control, keep the wings level, obtain assistance, and trust the flight instruments (not false sensations). Relax and do not panic. A trimmed airplane is stable with no control input in IMC just like in VMC.

REFERENCES

1. FAA-H-8083-3A, Airplane Flying Handbook, Chapter 16.
2. POH / AFM, Pilot Operating Handbook / FAA-Approved Airplane Flight Manual.