PRIVATE PILOT

XI. AREA OF OPERATION: NIGHT OPERATION
TASK: NIGHT PREPARATION

OBJECTIVE

To determine that the applicant exhibits knowledge of the elements related to night operations by explaining:

1. Physiological aspects of night flying as it relates to vision.
2. Lighting systems identifying airports, runways, taxiways, obstructions, and pilot controlled lighting.
3. Airplane lighting systems.
4. Personal equipment essential for night flight.
5. Night orientation, navigation, and chart reading techniques.
6. Safety precautions and emergencies unique to night flying.

ELEMENTS

1. Physiology of night vision:
    a. In addition to cones (the primary visual receptors in daylight), the eyes also use rods as the receptors for night vision, sending signals through the optic nerve to the brain.
    b. The rods can take up to 30 minutes to fully adapt to darkness.
    c. Once adapted to darkness, rods are 10,000 times more sensitive to light than cones.
    d. The concentrated cones in the concave fovea produce a night blind spot in the center of the field of vision, requiring a scan 5° to 10° off-center.
    e. A bright light can completely destroy night adaptation. Covering or closing one eye while experiencing a bright light at night can preserve that eye's night adaptation.
    f. Red cockpit lighting helps preserve night vision, but distorts other colors and washes out the color red (including the magenta text and markings on aeronautical charts).
    g. Instrument panel lights should be set at a minimum to enhance outside vision.
    h. Night acuity is further reduced by vitamin A or C deficiencies, carbon monoxide poisoning, smoking, alcohol, certain drugs and the lack of oxygen.
2. Night visual illusions:
    a. Autokinesis:
        i. Caused by staring at a single point of light for more than a few seconds.
        ii. After a time, the light appears to move
        iii. To prevent, keep eyes scanning objects of varying distances.
    b. False horizons:
        i. Caused by stars, shoreline lights or city lights "replacing" the natural horizon.
        ii. To prevent, use multiple visual reference points and backup with instruments.
    c. Flicker vertigo:
        i. Caused by flickering light in the cockpit (anticollision light or strobe lights).
        ii. Can produce nausea, dizziness, unconsciousness, headaches or confusion.
        iii. To prevent, temporarily eliminate the flickering light source.
    d. Night landing illusions:
        i. Above featureless terrain at night, there is a normal tendency to fly a lower-than-normal approach.
        ii. Visual obstructions such as rain, haze, or a dark runway environment can cause low approaches.
        iii. Bright light, steep surrounding terrain and a wide runway can produce the illusion of being too low.
        iv. A set of regularly spaced lights along a road or highway can appear to be runway lights.
        v. To prevent night landing illusions, thoroughly review the airfield layout and boundaries before initiating an approach.
    e. Pilot equipment:
        i. At least one flashlight (preferably red/white swappable) with spare batteries.
        ii. Current aeronautical charts (the lights of cities and towns can be seen at surprising distances at night).

f. Airplane equipment and lighting - remember P.A.L.E.S. as required night equipment:
   i. Position lights (right or starboard = green, left or port = red, aft or stern = white).
   ii. Anti-collision light (flashing red or white light).
   iii. Landing light (for compensation or hire only).
   iv. Electrical source (i.e. battery).
   v. Spare fuses, or alternative electrical source (i.e. alternator or generator).
g. Airport and navigation lighting aids:
   i. A rotating beacon is used to indicate the location of most airports (white + green = civilian land, white + yellow = civilian water, dual-peak white + green = military).
   ii. Steady or flashing red beacons indicate obstructions hazardous to navigation.
   iii. High intensity flashing white lights are used to identify tall towers.
   iv. Runway edge lights are white. Yellow may be substituted 2000' from the far end.
   v. Runway threshold lights are green and runway end lights are red.
   vi. Taxiway edge lights are blue and taxiway centerline lights are green.
h. Preparation and preflight:
   i. Pay particularly close attention to temperature / dewpoint spread.
   ii. Emphasis should also be placed on wind directions and speeds.
   iii. Course lines on charts should be drawn thick and in black.
   iv. Prominently lighted checkpoints and radio navigation aids should be used.
i. Starting, taxiing and runup:
   i. Cockpit materials should be readily available and convenient to use.
   ii. Ensure the propeller area is clear and turn the rotating beacon on.
   iii. Before moving, the taxi or landing light should be turned on (and intermittently off to avoid temporarily blinding other pilots).
   iv. Maintain taxiway centerlines and taxi slower than normal.
j. Takeoff and climb:
   i. Adjust cockpit light to a minimum brightness to enhance outside vision.
   ii. After the airplane is aligned with the centerline, note heading indicator.
   iii. Check the flight instruments during takeoff to ensure centerline heading, pitch attitude and airspeed.
k. Orientation and navigation:
   i. Usually, the first indication of flying into restricted visibility conditions is the gradual disappearance of lights on the ground.
   ii. If light appear to be surrounded by a halo, the pilot should use caution if attempting further flight in the same direction due to ground fog.
   iii. The horizon is difficult to see when crossing large bodies of water at night.
l. Approaches and landings:
   i. Identify runway lights as early as possible. If pilot-controlled lighting (PCL) is available, turn the lights on to maximum capacity (7 microphone clicks).
   ii. Increase emphasis on instruments, especially the altimeter and ASI.
   iii. Use the VASI or PAPI if available.
   iv. At night, the judgment of height, speed and sink rate is impaired.
   v. When tire marks on the runway are visible, begin the rollout and gradually reduce the throttle to idle and let the airplane touch down.

REFERENCES

1. FAA-H-8083-3A, Airplane Flying Handbook, Chapter 10.
2. AC 61-23 / FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge, Chapter 15.
3. AC 67-2, Medical Handbook for Pilots.
4. AIM, Aeronautical Information Manual.
5. POH / AFM, Pilot Operating Handbook / FAA-Approved Airplane Flight Manual.