

## Flight Lesson: Night Operations

### Objectives:

1. for the student to exhibit knowledge relating to the elements of night flight, including physiology, lighting, airport operations, navigation, FARs
2. gain experience flying at night

### Justification:

1. many flights require night operations
2. develops student's confidence in navigation and night operations
3. there are minimum night requirements for the private pilot checkride

### Schedule:

Activity	Est. Time
Ground	0.75
Preflight/Taxi	0.5
Flight	1.0
Debrief	0.25
<b>Total</b>	<b>2.50</b>

### Elements Ground:

- night physiology
  - the eye
  - adaptation
  - scanning
- night equipment
  - personal
  - aircraft
- aircraft lighting
- airport lighting

- takeoff and departure
- navigation
- approaches and landings
- emergencies
- applicable FARs

### Elements Air:

- night takeoffs and landings
- night cross country

### Completion Standards:

1. when the student understands the physiology of night flight
2. when the student understands the lighting configurations of airplanes and airports for night operations
3. when the student understands what is required of oneself and aircraft to be able to flight at night
4. when the student is able to competently takeoff, land, and navigate at night

### Common Errors:

- fails to use night scanning technique to locate traffic
- high and fast landing approach

## Presentation Ground:

### Night Physiology

#### 1. The eye

- (1) light rays pass through the pupil of the eye and are focused by the lens onto the retina, which is a light sensitive layer at the back of the eye
- (2) cones
  - i. central part of the retina contains cone cells, which are most effective in daylight and least effective in darkness
  - ii. cones allow us to see color, small details, and distant objects
- (3) rods
  - i. the outer band of the retina contains rod cells, which are responsible for your peripheral vision, and are effective in both daylight and darkness
  - ii. they are sensitive to movement, but not to detail or color, and so only register black, white, and gray

#### 2. adaptation

- (1) it takes the eyes about 30 minutes to adapt to a dark environment
- (2) the rate at which dark adaptation occurs depends on the contrast between the level of brightness and the level of darkness of the new environment
  - i. for this reason, bright lighting should be avoided prior to night flying
  - ii. this is not to say, don't preflight with a flashlight or flight plan in a dark room. just minimize the amount of exposure
  - iii. the best thing to do is dim the cockpit lights during taxi
- (3) also, smoking reduces the amount of oxygen your body gets, and thus should also be avoided
  - i. it can be equivalent to adding 5000 ft in altitude
  - ii. fatigue, colds, alcohol, etc. effect night vision

#### 3. scanning for other aircraft

- (1) since rods are the only sensitive cells in your eyes at night
  - i. scanning should be done with off center viewing (peripheral view)
  - ii. you will see objects better when your eyes are looking to one side of the object at night, rather than straight at them as in daylight
- (2) if you suspect traffic or an object somewhere, don't look directly at it...this may cause it to become more "invisible"
- (3) scan small parts at a time

#### 4. other good habits

- (1) close one eye when exposed to bright light to reduce effects of blinding
- (2) move the eyes more slowly at night
- (3) blink the eyes if they become blurry
- (4) concentrate on seeing objects
- (5) force the eyes to view off center

### Night Equipment

#### 1. personal equipment

- (1) a flashlight is imperative to proper night operations
  - i. provides adequate lighting for the pre-flight inspection

ii. colored lens (red or orange) is better for cockpit uses because it will minimize ruining your night vision

(i) note: colored lens may reduce your ability to see certain colors (i.e. on a chart)

## 2. aircraft equipment

(1) the equipment necessary for night operations can be remembered with two acronyms

(2) day VFR - TOMATO FLAAMES:

- i. **T**achometer
- ii. **O**il pressure
- iii. **M**agnetic compass
- iv. **A**irspeed indicator
- v. **T**emperature sensor (if liquid cooled)
- vi. **O**il temperature gauge (if air cooled)
  
- vii. **F**uel gauges
- viii. **L**anding gear position indicator lights
- ix. **A**ltimeter
- x. **A**nti-Collision lights (if manufactured after 3/11/1996)
- xi. **M**anifold pressure gauge
- xii. **E**LT
- xiii. **S**eat belts

(3) Night VFR:

- i. **F**uses (spares) or circuit breakers
- ii. **L**anding lights (if for hire)
- iii. **A**nti-collision lights
- iv. **P**osition Lights
- v. **S**ource of energy (adequate to power all electrical and radio equipment)

## 3. aircraft lighting

(1) Position lights

- i. green on right, red on left, white on rear
- ii. scenarios:
  - (i) red-to-green is potentially dangerous
  - (ii) same color to same color is safe
- iii. on required on between sunset and sunrise

(2) anti-collision lights

- i. can either be a red beacon or white strobe lights
- ii. they must be on at all times (except in the interest of safety)

## 4. airport lighting

(1) airport beacon

- i. designed to help a pilot visually locate an airport from some distance away
- ii. some transmit pulses of light, some rotate, but the effect is the same
  - (i) Green - White - Green - White = civil airport
  - (ii) G - W - W - G - W -W = military airport
  - (iii) Yellow - W - Y - W = helicopter landing

(2) taxiway lighting

- iii. taxiways are lit in two possible ways
    - (i) two lines of blue lights that mark the edges of the taxiway
    - (ii) one line of green lights marking the center of the taxiway
  - iv. centerline lights are flush (or almost) with the ground and can be taxied over
  - v. edge lights are *not* flush
  - vi. there may be red “stop bars” installed, indicating where an airplane should hold position
- (3) runway lighting
- i. runway lighting defines the boundaries of the actual landing area
  - ii. some advanced systems provide distance down the runway information as well
    - (i) not necessary for VFR pilots who should be able to see the end of the runway
  - iii. runway edge lights : *white lights that outline the edges of runways during periods of restricted visibility or darkness*
  - iv. runway end lights : *have two colors, showing green at the near end to the aircraft on approach, and red to the airplanes stopping at the far end*
  - v. runway end identified lights (REIL) : *pair of synchronized flashing white lights located on each side of the runway threshold at the approach end*
    - (i) server to identify runways surrounded by lots of other lights, or in poor visibility
- (4) visual approach slope indicators (VASI)
- i. two bar red-on white VASI
    - (i) red over white- on glide path
    - (ii) white over white - above glide path
    - (iii) red over red - below glide path
    - (iv) only provides guaranteed obstacle clearance 4 NM out from threshold
- (5) pilot controlled lighting
- i. at some airports when ATC and/or FSS are not manned 24 hours a day, airborne control of the lighting by the pilots is sometimes available using a VNF-COM frequency (usually the CTAF)
  - ii. The A/FD specifies the type of PCL available and the frequency it is activated on
    - (i) sectional and terminal charts have a \* next to lighting indication if “some limitations on lighting exist”
      - a. usually this implies pilot controlled lighting
  - iii. to activate, “key” the mike between 3 and 7 times within 5 seconds.
    - (i) this will give low, medium, or high intensity depending on how many keys, and what is available
  - iv. lights will stay on for 15 minutes from last “keying” so reactivation is a good idea as you enter the pattern

### **Takeoff and Departure**

1. flight at night is similar to flying in the daytime, only there is a lack of visual references
  - (1) instruments must be references a lot more at night
2. the key to night flight is caution:
  - (1) make sure the instruments can be read well
  - (2) make sure traffic separation is assured
3. when on the runway, align aircraft between runway edge lights (or centerline)
4. takeoff technique is the same.

1. at correct speed rotate to the climb attitude by looking outside, AND the instruments
2. ensure aircraft continues a positive rate of climb by monitoring the altitude indicator and VSI

### **Navigation**

1. as with all flights requiring navigation, get all possible information concerning the flight
2. VFR cloud clearances and visibility apply for night flight
  - (1) typically 500 ft below, 1000 ft above, 2000 ft horizontal; 3 miles visibility
3. continually scan the sky for aircraft
4. during cross country
  - (1) lighting in the cockpit should be reduced so your vision will stay adapted
  - (2) it is good to choose well lit landmarks for pilotage (including cities which are highlighted in yellow on charts)
  - (3) use radio navigation to its full potential
  - (4) be aware of all lit and unlit obstructions which may pose a hazard on your route of flight

### **Approaches and Landings**

1. as possible, landings at night should be no different than landings during the day
2. important to identify an airport as soon as possible ( in any approach situation, but especially night operations) so the pilot can plan for proper traffic pattern entry
3. in an unfamiliar area, the runway may be hard to identify, and in this case, look for the beacon
4. distances, altitudes, and airspeeds cannot be determined as well as during the day (due to lack of references) thus a reliance on instruments may be required more
  - (1) inexperienced pilots have a tendency to make approaches with excessive speed
5. upon entering pattern, crosscheck the instruments for altitude and airspeed, as well as looking out for position in the pattern
6. on final, align the aircraft with the runway lights, and when possible, use the VASI for glide slope information
7. make sure the landing light is on to assist with the landing
8. round out and touchdown should be made in the same manner as day, but your judgement of height, speed, and sink will be impaired.
  - (1) use clues such as landing light against the runway, or the height of the runway end lights compared to your airplane to aid in judgement
  - (2) look over nose down the end of the runway

### **Night Emergencies**

1. if an engine fails at night, the pilot must react as during the day
2. pilot will not be able to pick a field as easily
3. flight away from congested areas is recommended and orientation of wind direction should be maintained to avoid downwind landings
4. when landing, if unable to see the ground, the plane should be kept level until the ground is contacted
  - (1) **never** allow the plane to stall

### **Night Currency**

1. pilot must have flown three takeoffs and landings to a full stop between one hour after sunset, and one hour before sunrise within 90 days
2. night landings count for day landings for currency

## **Presentation Air:**

1. night pattern work
  - (1) Takeoffs and departures
  - (2) approaches and landings
2. night cross country
  - (1) navigation and orientation practice