Importance to Members

Night flying has both benefit and beauty – there is usually less air traffic to contend with, and a clear night offers beautiful star-studded skies above and twinkling towns below. However, the limitations that darkness puts on human vision, along with the effects of pilot fatigue at day's end raise the risk of night flying. Statistically, although there are not as many accidents at night as during the day, those accidents that do occur have a significantly higher fatality rate. The AOPA Air Safety Foundation's 2008 Nall Report states, "Though the total numbers [of accidents] are lower, accidents at night are more than twice as likely to be deadly as those during daylight."

This subject report touches on the main issues involved in night flying: The limitations of night vision, night illusions, lighting and night blindness, weather minimums, regulations, and tips for making your night flight pleasurable and safe. A sizeable list of Additional Resources includes articles from *AOPA Pilot* and *AOPA Flight Training* written by aviation experts who share their night flying experiences and accumulated wisdom.

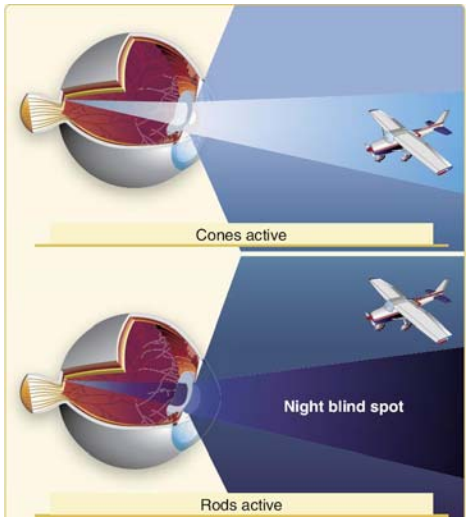
And if you have questions, give us a call in AOPA's Pilot Information Center– 800-USA-AOPA (872-2672) Monday through Friday, 8:30 to 6:00 ET.

Overview

This subject report contains important information relating to night flying, and should be used to help educate and prepare for a night flight. The report covers everything from aero-medical factors surrounding night flying, to terrain avoidance procedures when flying at night. Aero-medical factors discussed range from how the eye processes decreased visible light at night, to the illusions a pilot may encounter at night. Need a refresher on the federal regulations dealing with night flying? This subject report will walk you through what is required for recency, certification, weather minimums, and much more.

Technical Information

Vision



Effective vision and viewing techniques are essential for pilots flying at night. As the sun sets, our familiar looking earth undergoes a full makeover. Depth and altitude perceptions are severely altered, and visual acuity diminishes.

To understand night vision we must begin by understanding how our eyes work. Our eyes are comprised of rods, and cones. Cones are responsible for all color vision, and are concentrated toward the back of the retina. Rods, on the other hand, are unable to discern color, but are very sensitive in night viewing. During night flight effectiveness of vision is augmented by the facilitation of off-center viewing. Off-center viewing is a technique that requires one to look slightly off-center, and not directly at an object they are trying to see. To make the best of our night vision, eyes should not be exposed to any bright lights 30 minutes prior to the time of flight. Exposure to light could cause temporary blindness, and drastically decrease our night vision. This is something we must keep in mind when taxiing around other aircraft, as our strobe lights may ruin another pilot's night vision. Using strobes while taxiing would be comparable to driving at night with your high beams on all the time. Runway End Identifier Lights, seen as flashing strobes at the end of some runways, should not be stared at while taxiing because doing so could cause temporary blindness.

A few tips:

- Use a white light for preflight inspection, but red for cockpit lighting.
- Deficiency in vitamins A and C have been shown to reduce night vision, so eat up.
- Factors such as carbon monoxide poisoning, smoking, alcohol, and drugs can gravely decrease night vision.
- A lack of oxygen can deeply impact night vision as well. As a result, the FAA recommends pilots use supplemental oxygen (if available) at altitudes as low as 5000 feet during night flights.

Lighting

Don’t forget a flashlight! A large handheld white-light flashlight should be used to aide in the preflight inspection. When entering the cockpit, be sure you have at least one flashlight (if you only have one flashlight, bring spare batteries) that is easily accessible from your position in the aircraft. Preferably this flashlight would be dimmable and/or capable of switching between white and red light. Red light preserves night vision, but makes sectional charts very difficult to read as it washes out all red color. Special attention should be paid to the aircrafts internal, and external lighting. Be sure you know where all of the switches are located, and make sure your electrical system is in good condition.

Illusions

Now that we understand how our eyes work at night, it’s time to learn about certain illusions that can be hazardous during night flight.

- **Autokinesis:** Caused by staring at a single point of light against a dark background for more than a few moments, autokinesis will make the light appear to move on its own. To help prevent this, focus on a variety of objects, and maintain a constant scan.
- **False Horizon:** This can occur when the real horizon is obscured, or by confusing lights and stars. Pilots should be especially aware of this illusion when flying toward a shoreline as the dark water may make the shore lights easily confused with stars. As a result, the pilot aligns the aircraft nose with the shore instead of the horizon. To prevent this monitor your attitude instruments for an accurate indication of your pitch.
- **Clouds:** Though not an illusion, the presence of clouds on a nighttime VFR flight can be hazardous. To ensure you don’t unintentionally fly into clouds, it’s important to get a thorough pre-flight weather briefing as well as in-flight updates. If you do fly into clouds it’s important to use your instruments, not instincts, to maintain positive control of the aircraft.
- **Landing Illusions:** There are many different kinds of night landing illusions, many of which lead unfavorable approaches and landings. A lower-than-normal approach is most often a result of visual obscurations such as rain, haze, or even a dark runway environment. Bright lights, steep terrain, and wide runways can produce the illusion of being too low – resulting in a higher-than-normal approach. Highway lights are easy to mistake for runway lights at night; be sure you are approaching a runway, not a highway.

Weather Minimums

The basic VFR weather minimums of FAR 91.155, which are complicated, yet which every pilot is held to know, for the most part do not differentiate between night and day. It is only for operations in Class G (uncontrolled) airspace that the regulation specifies some higher minimums for night flight. The minimums in the other classes of airspace, all controlled (Classes A, B, C, D, and E), are the same, night and day.

The daytime minimums for Class G airspace (below 10,000 feet msl and above 1,200 feet above the surface) are visibility of 1 mile and clearance from clouds of 500 feet below, 1,000 feet above, and 2,000 feet horizontal. At 1,200 feet or less above the surface (regardless of msl altitude) the daytime cloud clearance minimum is "clear of clouds." That's pretty significant. At or below 1,200 feet agl in uncontrolled airspace, we can operate daytime VFR with as little as one-mile visibility and clear of clouds.

At night, the visibility minimum for uncontrolled airspace increases to three statute miles for both altitude spectrums, making it the same as in controlled airspace. The cloud clearance minimums at night, while the same as controlled airspace for operations above 1,200 feet above the surface, increase for lower altitude operations from "clear of clouds" to the same as controlled airspace, i.e., 500 feet below, 1,000 feet above, and 2,000 feet horizontal distance from clouds. So, at night, the VFR weather minimums in all uncontrolled airspace up to 10,000 feet msl are the same as controlled airspace. In other words, there are no relaxed VFR weather minimums at night in uncontrolled airspace.

Weather Tips

- **Personal Minimums:** A common practice of many night VFR pilots is to double their weather minimums over open land (at night) and quadruple their minimums over mountainous terrain. This helps to ensure the pilot does not operate near any weather that he/she is not comfortable with.
- **Fog:** Another careful weather consideration when flying VFR at night is the temperature/dew point spread. As most pilots know, a small spread (or no spread) means increased chances of encountering fog, or some form of visible moisture.
- **Notams:** When getting your night weather briefing be sure to look for notams that may affect your capability to safely conduct a night flight. An example would be a notam saying that runway lights, or a rotating beacon at your destination airport are inoperative.

Fuel Requirements

The fuel requirements for flight in VFR conditions, as specified in FAR 91.151 (see "Pilot Counsel: VFR Fuel Requirements," January 2000 Pilot), are increased for night operations. At night, a flight under VFR conditions must begin with enough fuel to fly to the first point of intended landing, and to fly after that for at least 45 minutes assuming normal cruising speed. The daytime minimum is 30 minutes. The fuel requirement for rotorcraft VFR flight is not different for night. Day or night, the flight must begin with 20 minutes fuel reserve. As a reminder, in computing these fuel requirements a pilot must consider wind and forecast weather conditions. The fuel requirements for flight in IFR conditions are not different for night or day.

Certification rules for night flying

A specified amount of night flying is required for certification as a private or commercial pilot. For example, under FAR 61.109, an applicant for a private pilot certificate must generally (there are restrictive exceptions) have at least 3 hours of night flight training that includes a long cross-country flight and 10 takeoffs and 10 landings in a single-engine or multiengine airplane, depending on the rating sought. Under FAR 61.129, an applicant for a commercial pilot certificate has comparable night flight-training requirements and exceptions. There are similar night flight-training requirements for helicopter and other ratings. All of this night time is required to be computed with reference to the technical regulatory definition of night in FAR 1.1.

Recent experience requirements

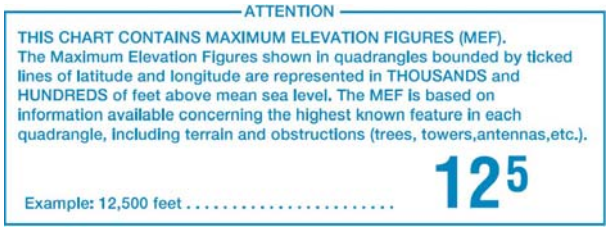
On the other hand, here is one of the places that the definition of night is different from the FAR 1.1 definition. FAR 61.57(b) contains the recent night-flying experience requirements to carry passengers at night. The title of the regulation uses the term "night" but only implicitly defines that term as the "period beginning one hour after sunset and ending one hour before sunrise." This definition is narrower. It makes shorter the period of darkness when this night flying experience may be gained.

To refresh, the rule requires that a pilot must have made at least three takeoffs and three landings to a full stop during nighttime, as it is here narrowly defined, in order to be current to carry passengers during a nighttime period defined in the same way. The required takeoffs and landings must have been made in an aircraft of the same category, class, and type (if a type rating is required), or in an approved training center simulator adjusted to simulate night.

Night special VFR

The opportunity to operate special VFR under FAR 91.157 — that is, with lower than basic VFR weather minimums — is more restrictive at night. The term "night" does not appear in this regulation. Rather, it is implied because according to the regulation special VFR operations may only be conducted "between sunrise and sunset" — unless the flight meets other criteria. So, essentially it is a nighttime restriction, night being implicitly defined as the time other than "between sunrise and sunset." Unless the operation is between sunrise and sunset, a special VFR operation may not be conducted unless the aircraft is equipped for IFR flight and the pilot is IFR rated and current. During daytime special VFR operations, these IFR restrictions do not apply. The IFR restrictions do not apply to helicopters. In Alaska, the IFR restrictions apply unless the operation is when the sun is six degrees or more above the horizon.

Terrain Avoidance



An area of flying that is always important; terrain avoidance is made more difficult at night. To aide in terrain avoidance, careful attention should be paid to the Maximum Elevation Figure (MEF) published on sectional charts. The Maximum Elevation Figure (MEF) represents the highest elevation, including terrain and other vertical obstacles (towers, trees, etc.), within a quadrant. A quadrant on Sectionals is the area bounded by ticked lines dividing each 30 minutes of latitude and each 30 minutes of longitude. MEF figures are depicted to the nearest 100' value. The last two digits of the number are not shown. In this example the MEF represents 12,500'. MEFs are shown over land masses as well as over open water areas containing man-made obstacles such as oil rigs. A Minimum Enroute Altitude should be picked based off the MEF, and other factors such as airspace. Holding this altitude will keep you, your passengers, and your plane safe during night flights, when seeing the ground is often difficult, and in some cases not possible.