January/February 2025

# BRIEFING FADSafety

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Federal Aviation Administration

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U.S. Department of Transportation

#### Federal Aviation Administration

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#### ABOUT THIS ISSUE ....



The January/February 2025 issue of FAA Safety Briefing focuses on general aviation night operations. Feature articles cover what's required for night flight, how to mitigate visual illusions, and pro tips for overcoming your fear of the dark.

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## BRIEFING FAA) Safety

The FAA Safety Policy Voice of Non-commercial General Aviation





Vampire Rules What You Need to Fly at Night



Your Senses in the Shadows



A New Look for Night Lights

Lighting LED Migration Plan

An Update On the FAA's Approach

- Nighttime Visual Illusions and Spatial Disorientation
- **Developing Your Night Flight Plan** A Guide to Avoid Things That Go Bump in the Night
- Don't Be Afraid of the Dark Practice, Preparation, and Proficiency for Safe and **Enjoyable Night Flights**
- The Path to Unleaded Avgas A Critical Transition 26 for Aviation

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#### THE ART OF NIGHT FLIGHT

Welcome to our first issue of 2025! As we embark on a brand-new year, it's the perfect time to reflect on our recent accomplishments and identify a few areas to improve or challenge ourselves with in the months ahead. Some may look to improve their health or read more, while others might resolve to spend more time with family and friends. All are noble pursuits worthy of some renewed focus. Pilots may also endeavor to have a separate set of resolutions for the new year; maybe it's flying a different aircraft, knocking the rust off your instrument approaches, or perhaps focusing on the subject of this issue, night flying.

I'm sure most pilots would agree with the many endearing features of dusk-to-dawn flight - calmer air, quieter frequencies, better performance, and the tranquility that only soaring over moonlit landscapes can offer. But night flying is not without risk. As you'll read in these pages, night flight represents a small percentage of total flying hours but has a significant number of incidents and/or accidents. Much of that is due to a loss of visual cues pilots use to navigate and maintain the orientation of their aircraft, especially with no moonlight or city lights to help guide them.

Given the smaller margins for error that come with flying in the dark, pilots need to keep their skills sharp by staying both current and proficient. You also need to be aware of the rules and regulations for night flying that apply to both the pilot and the plane. You can navigate through many of these regulations in the article "Vampire Rules: What You Need to Fly at Night," so you'll have everything you need to know about being legal and safe when traversing through the dark.

As we highlighted in last year's instrument flying issue, pilots are prone to several illusions while flying without reference to a horizon, many of which can have deadly consequences if not properly mitigated. Nighttime operations offer many of the same dangers, along with some optical illusions that can completely disorient a pilot and compromise safety. We unravel the mystery of many of these illusions in the article "Your Senses in the Shadows" and provide a few solid strategies to keep these misleading manifestations at bay.

Helping to literally shed light on the dangers of darkness is the advent of LED technology. LED lights provide a host of benefits including increased reliability, lower costs, and more accurate color. You may have noticed the more brilliant glow of LEDs used in some areas of airfield lighting, and soon you'll see them lighting the way in hundreds of approach lighting systems across the nation. Get more illuminated on the benefits of LEDs in the article "A New Look at Night Lights."

With the loss of visual cues and terrain visibility at night comes the increased risk of controlled flight into terrain (CFIT) accidents. While extremely deadly, these accidents are also very avoidable with proper planning and preparation. For tools and tips on how to "avoid things that go bump in the night," be sure



to read "Developing Your Night Flight Plan."

While night flying does have some added risks, there's a tremendous upside to cruising the night sky. In the article "Who's Afraid of the Dark?," we talked to a few experts to get some night insight on the many benefits this type of flying offers, as well as some takeaways that can help calm any nocturnal nerves.

We hope these articles offer some helpful guidance and inspiration to those pilots who wish to embrace or reconnect with the joy of night flight. With the proper precautions, taking a leap back into the dark can be extremely rewarding and enjoyable.

Safe flying, and here's to a safe and successful 2025!

#### **AVIATION NEWS ROUNDUP**

#### New Rule for Public Aircraft

The FAA recently published a final rule that allows pilots conducting public aircraft operations to credit their flight time towards FAA civil regulatory requirements. Additionally, consistent with the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023, this final rule amends the operating rules for experimental aircraft to permit certain flight training, testing, and checking in these aircraft without a letter of deviation authority. As directed in the FAA Reauthorization Act of 2024, the same relief will be extended to certain flight training, testing, and checking in limited category, primary category, and experimental light sport aircraft. This final rule also revises miscellaneous amendments related to recent flight experience, flight instructor privileges, flight training in certain aircraft holding special airworthiness certificates, and the related prohibitions on conducting these activities for compensation or hire.

You can review the final rule at federalregister.gov/d/2024-22009.

### FAA Completes Framework for Air Taxis

The FAA is ready for powered lift, the first completely new category of civil aircraft since helicopters were introduced in the 1940s. Powered lift operations include air taxis, cargo delivery, and a variety of operations within urban and rural areas.

The agency issued a final rule for the qualifications and training that instructors and pilots must have to fly aircraft in this "powered-lift" category, which has characteristics of both airplanes and helicopters. The rule also addresses their operational requirements, including minimum safe altitudes and required visibility. The rule is the final piece in the puzzle for safely introducing these aircraft in the near term. The opportunities for the use of powered lift operations are far-reaching. They range from transporting passengers in urban areas and short-haul operations, such as air ambulance services and cargo operations, to potentially serving smaller communities over time.

For more information, read the Medium blog article at bit.ly/48pnO8j and visit the advanced air mobility



webpage at faa.gov/air-taxis.

#### Verticon 2025

Formerly HAI Heli-Expo, Verticon 2025, the world's largest vertical aviation conference and trade show, will be held March 10-13 in Dallas. The event will feature 125-plus education courses and safety sessions and provide networking opportunities with 15,000 industry professionals and more than 600 exhibitors. For additional information, visit verticon.org.

#### FAA Publishes Rule Removing CFI Expiration Dates

The FAA published a final rule eliminating expiration dates on flight instructor certificates, replacing them with recent experience requirements every 24 calendar months. Removing the expiration date on certificates increases efficiency, cuts costs, and aligns instructor certificates with other airman certificates, such as private and commercial, which do not expire.

Under the new rule, instructors must still renew their certificates every 24 calendar months by completing a flight instructor refresher clinic (FIRC), obtaining an additional instructor certificate, or engaging in further instructional activities. Additional activities must include

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Please visit bit.ly/FlySafeMedium for more information on these and other topics.



#### JANUARY

Safety Culture – Exploring the many benefits of a strong safety culture in aviation.



#### FEBRUARY

Survival – How training and planning before flight can improve a pilot's chances of survival after an accident/incident. "at least 15 flight activities recognized under the FAA-sponsored pilot proficiency program," during which the flight instructor evaluates at least five different pilots and makes the required endorsements in each pilot's logbook for every activity. The rule also specifies that flight instructors who endorse at least five applicants for a practical test within 24 calendar months who maintain an 80% pass rate can also utilize this provision to renew their certificates.

The FAA estimates that the rule will result in \$5.6 million in cost savings for both the FAA and the industry over five years. You can review the final rule at federalregister.gov/d/2024-22018.

#### New Video Reviews Line Up and Wait

In case you missed the article "Please Wait Your Turn" in the Sep/Oct 2024 issue, the line up and wait instruction is used by air traffic control (ATC) to inform a pilot to taxi onto the departure runway to line up and wait. It is not authorization for takeoff. So, why do pilots depart when they are instructed to line up and wait? The answer lies in a variety of human factors that can lead pilots to mistakenly depart. A recent From the Flight Deck video explores some real-life events and discusses the factors that contribute to an unauthorized takeoff roll when a pilot is instructed to line up and wait. See this and past videos

at faa.gov/flight\_deck.

#### FAA Hits Air Traffic Controller Hiring Goal

The FAA exceeded its goal of hiring 1,800 air traffic controllers in 2024, with a final total of 1,811 for fiscal year 2024. As the largest number of hires in nearly a decade, this marks important progress in the FAA's work to reverse the decades-long air traffic controller staffing level decline.

The FAA currently has more than 14,000 air traffic controllers. With this year's addition, there are now around 3,400 controllers in various stages of training, ranging from initial instruction at the FAA Academy in Oklahoma City to specialized airspace training for positions at one of the FAA's hundreds of air traffic facilities.

To help the agency meet its hiring goal, the FAA continuously recruits controllers with prior air traffic experience from the military and private industry.

#### FAA Updates BasicMed Program

The FAA updated its BasicMed regulations to allow pilots to operate larger aircraft and carry more passengers. BasicMed, which took effect in 2017, allows pilots to fly without holding an FAA medical certificate provided they meet certain conditions.

The FAA Reauthorization Act of



2024 required the FAA to expand BasicMed to:

- Increase the number of allowable passengers to six from five, and the number of occupants to seven from six.
- Increase the maximum aircraft takeoff weight to 12,500 pounds from 6,000 pounds, excluding transport category helicopters.
- Allow pilot examiners to conduct flight checks using BasicMed in aircraft that are covered by the BasicMed rule.

Pilots must meet specific conditions to operate under BasicMed. Among other things, they must have held a valid medical certificate at some point after July 14, 2006; the most recent medical certificate cannot have been denied, revoked, or suspended; they must complete a medical exam by a state-licensed physician; they must complete an online medical education course; and they must hold a valid U.S. driver's license.

BasicMed also includes certain limitations, including that pilots cannot fly for compensation or hire and are restricted to flying at or below 18,000 feet altitude and at a speed no greater than 250 knots. Learn more at bit.ly/3ObJprC.

#### AMEs Can Issue a Medical Certificate After a DUI

It is possible for an aviation medical examiner (AME) to issue your medical certificate with a history of DUI under certain circumstances. For example, if you previously reported a DUI on MedXPress and there have been no new events and you don't require any kind of monitoring as documented in a letter from the FAA, the AME can issue your certificate. Federal Air Surgeon Dr. Susan Northrop explains more about the path to certification after a DUI and the information required for a pilot to submit in this recent episode of the Pilot Minute video series. To watch this and other videos, visit bit.ly/FAAPilotMinute.

I would like to take the opportunity to outline our 2025 goals in the FAA Office of Aerospace Medicine. Some are concrete and easily measurable; others are aspirational but just as important. Recall from the previous issue that we are concerned about both sudden and subtle incapacitation; we must not only consider you the pilot, but society at large. When we can assure ourselves that the risk is acceptable, then we can issue a medical certificate.

#### My goals include:

- In support of the Air Traffic Organization's air traffic control specialist (ATCS) hiring goal to reduce the shortage, medically certificate at least 2,500 ATCS applicants for the FAA Academy. (This is almost double what we cleared just a few years ago.)
- Fill 95% of all medical officer vacancies to reduce the amount of time necessary to medically certify ATCS candidates and pilot applicants. (Not only have we seen an increase in ATCS applications, but the number of pilot applicants and the complexity of their medical histories have also increased dramatically. We are also seeking to increase the number of aviation medical examiners (AMEs) available for pilot medical certification.)
- Increase the number of behavioral health specialists on my staff by 25%. (Even though we are granting the AMEs more authority in decision-making, our internal workload has increased due to the expanded number of conditions and medications that we can now authorize.)
- Complete the Airman Medical Bill of Rights as directed by Congress.

- Create and initiate the Aeromedical Innovation and Modernization Working Group to decrease wait times and increase throughput for pilot medical processing. (Basically, we are doing an internal scrub to see how to increase our efficiency.)
- Continue validation of additional neurocognitive screening tests. (We are using the results of a recent survey of pilots, our historical data, and current literature to improve our evaluation process and offer airmen more options.)

In addition to the above concrete, measurable goals, we are trying very hard to change the dynamic between FAA's Office of Aerospace Medicine and the pilot community. I like to refer to our approach as the three "E"s — Educate, Early Intervention, and Evolution of Standards. While the examples below focus on mental health and well-being, the same principles apply to any medical condition.

#### Educate

We are working to incorporate mental health literacy into training and testing events to provide the aviation community with the tools to manage fatigue and improve resilience. Additionally, we want to expand our current outreach to the community via air shows, meetings, AMEs, articles, pilot advocacy groups, webinars, etc. We are increasing AME mental health training and intend to publish practical guidelines to "unmedicalize" mental health in aviation. The entire aviation community must unite to overcome barriers to care.

#### **Early Intervention**

Prevention and early intervention will be critical to prevent or mitigate the effect of mental health issues. Not only is the path to return to safety sensitive duties much easier before the symptoms have progressed to major disease, but treatment progress is also generally more rapid. One important tool is peer support — early intervention to normalize feelings/perceptions and provide peer-to-peer understanding of available help.

#### **Evolution of Standards**

Despite early intervention and counseling, sometimes medical and mental health providers must treat with medications or other therapies. For many conditions and medications, we already have pathways to return aircrews to medical certification even during treatment. We have ongoing reviews to increase both treatment options and the number of conditions that we can authorize. However, it is always better to "nip it in the bud" before progression. We're working hard to remove the stigma and fear surrounding mental health. These have plagued the aviation community for far too long. Finally, we are exploring how to create a non-punitive pathway for disclosing mental health conditions and treatments. Pilots do not hesitate to get treatment for high blood pressure before it progresses to a heart attack or a stroke. My hope is that someday, it is just as acceptable to the aviation community to seek help for a mental health condition.

Dr. Susan Northrup received a bachelor's degree in chemistry, a medical degree from The Ohio State University, and a master's degree in public health from the University of Texas. She is double board-certified by the American Board of Preventive Medicine in Aerospace Medicine and Occupational Medicine. She is a retired U.S. Air Force colonel and a former regional medical director for Delta Air Lines. She is also an active private pilot and aircraft owner. What You Need to Fly at Night

By James Williams

"The approach of sunset was so very beautiful, so grand in its masses of splendidly-coloured clouds ..." — Bram Stoker's Dracula.

During last year's spooky season, I decided to brush up on my classic monster movies and fill in some frankly unforgivable gaps in my movie viewing history. In addition to Universal Studios' Frankenstein movies, I finally watched one of the Hammer Film Productions' Dracula movies. Hammer is famous for their gothic horror films, particularly from the 1950s through the 1970s. During the film, Dr. Van Helsing explains the rules for dealing with vampires. The most obvious is the "allergy" to sunlight. This relegates the vampire to strictly nighttime operations. But as pilots, nighttime operations aren't the curse of Dracula. As we explore in this issue, night flying can be a very pleasant experience. But we have some additional "vampire rules" to deal with before we prowl the night sky.

#### The Approach of Sunset

Before we dig into the letter of the law, so to speak, of night flying, let's discuss some general preparations that can be helpful. Even if you are already an experienced pilot but haven't done any night flying lately, getting in some practice with an instructor is always a good idea. In fact, if you're an active pilot who doesn't fly much at night, it would also be a great idea to schedule a few lessons a year to keep yourself from getting too rusty. Even if you don't intend to fly at night, it's a cheap insurance policy because you never know when your day flight might get delayed into the evening.

If you aren't familiar with the model or type of aircraft you intend to fly, you may want to find a time during daylight hours to do a walk around with an experienced pilot to get a good reference for what to look for in your preflight.

There are also some considerations regarding your aircraft to account for. If you aren't familiar with the model or type of aircraft you intend to fly, you may want to find a time during daylight hours to do a walk around with an experienced pilot to get a good reference for what to look for in your preflight. While it's perfectly fine to preflight after dark, you will likely benefit from more light during your initial walkthrough. Another preflight task that can be helpful if you don't own the aircraft is to take a quick look at the aircraft logs for any squawks, particularly regarding the electrical system and instruments.

#### The Dark Side of Twilight

We can put away the garlic and silver because our vampire rules are more focused on aeronautical experience and required equipment. But first, we need to establish what night is according to the FAA. Per Title 14, Code of Federal Regulations (14 CFR), section 1.1: "Night means the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time."

Hopping over to the National Weather Service for our next definition, civil twilight begins in the morning, and ends in the evening, when the geometric center of the sun is 6 degrees below the horizon. To translate that into something more usable for those of us without a sextant, it means light conditions under which objects can generally be discerned without artificial light, barring any obscuration like clouds or fog. You can easily find the times online by quickly searching for your location and civil twilight.

As for what you need to prowl the night sky, let's first look at rules for the pilot. Foremost, you must meet your certificate's training requirements (i.e., 3 hours of training at night, 100 nautical mile nighttime cross country, etc., for a private pilot). But for the purposes of this article, we're going to assume you have a pilot certificate without any night flying restrictions.

Our next hurdle is night currency. Before you can act as pilot in command (PIC), you must meet the requirements of 14 CFR section 61.57(b). Namely, three takeoffs and three landings to a full stop as the sole manipulator of the flight controls in the same category, class, and type of aircraft during the period one hour after sunset and one hour before sunrise. Note the slight definitional difference between night as defined in section 1.1 and the period required by section 61.57. These times may or may not line up as civil twilight will vary. So, you could have a time where it's technically night per 1.1 but does not meet the time required by 61.57 to perform night currency tasks.

#### The Air Almanac

The Air Almanac contains the astronomical data required for air celestial navigation. The book provides the following data tabulated at 10-minute intervals to a precision of 1 arcminute: the Greenwich hour angle and declination of the Sun, Moon, and three navigational planets; the Greenwich hour angle of Aries; rise and set times of the Moon for a range of latitudes; and other data. Each edition also contains sky diagrams for each month; sunrise, sunset, and twilight tables; and positions of the navigational stars. The Air Almanac is available nine months in advance of its edition date.

Beginning with the 2008 edition, the Air Almanac is available only in PDF format. It is expected that those requiring a paper copy of certain pages will have access to a printer. Starting with the 2015 edition, users may download the entire almanac free of charge, although the CD is still available for purchase through the Government Publishing Office (GPO).

— Astronomical Applications Department, U.S. Navy The Air Almanac (bit.Iy48VSi29)



While our trusty aircraft doesn't care whether it's day or night, we do have some additional requirements for our craft to operate safely. In addition to all the required equipment for a daytime flight under visual flight rules (VFR) per section 91.205(b), section 91.205(c) adds approved position lights, an approved anticollision light system, an adequate source of electrical energy for all installed radios and equipment, spare fuses if required, and one electric landing light if operated for hire at night. There are even more equipment requirements for instrument flight rules (IFR) flights. The list makes a lot of sense; frankly, most of those things are already equipped on many aircraft. But it's important to make sure those bases are covered.

#### **Required instruments:**

*	Airspeed indicator
*	Altimeter
≫⁄	Magnetic direction indicator
*	Tachometer for each engine
*	Oil pressure gauge
℀	Temperature gauge (liquid-cooled engine)/oil temperature gauge (air-cooled engine)
*/	Manifold pressure gauge (if applicable, usually for forced induction)
*	Fuel gauge
*	Landing gear position indicator (if applicable)

#### **Required equipment:**

*/	Seat belts (with shoulder harness if applicable)
*/	Emergency locator transmitter (ELT)
C	Position lights
C	Anticollision lights
C	Electric landing light (for hire ops)
C	Electrical system adequate for all required equipment
L	Fuses (if applicable)

Key	
-≯⁄	Required for Day and Night
C	Required for Night

Another operational concern is fuel reserves, which move from 30 to 45 minutes per section 91.151(a)2. Also, if you intend to use special VFR (SVFR) at night, you must hold an instrument rating, be current, and have an aircraft that meets the IFR requirements in section 91.205(d).

#### While it's perfectly fine to preflight after dark, you will likely benefit from more light during your initial walkthrough.

#### Enter Freely and Of Your Own Free Will!

Night flying can be a wonderful experience, and you may even come to prefer it. But there are factors that can make it more challenging, like the lack of visual references and encountering visual illusions. This emphasizes using instruments in combination with what references do exist. But once you get the hang of it, you will open up a whole new chapter in your flying adventure. Elsewhere in these pages (physical or digital) you can find additional tips to up your night flying expertise. Soon, you will freely enter the night, not as a castle of horror, but as a comfortable second home.

James Williams is FAA Safety Briefing's associate editor and photo editor. He is also a pilot and ground instructor.



# YOUR SENSES IN THE SHADOWS

Nighttime Visual Illusions and Spatial Disorientation

By Nicole Hartman

ike many kids, my daughters were afraid of the dark when they were young. Their inability to see in the darkness left them feeling vulnerable and exposed and caused their other senses (and imaginations) to run wild. Even though at a certain age they knew that monsters didn't exist, their guts still told them that something might be lurking under the bed, in the shadows. Fear of the dark is common in children and fortunately isn't dangerous in typical cases. However, false feelings at night are also prevalent in the cockpit and are far more hazardous.

#### During nighttime operations, pilots can fall victim to optical illusions that can drastically compromise their safety.

There are considerable benefits to flying at night. The darkness provides a different view, and you'll probably experience less chatter on the radio and smoother air. Check out "Don't Be Afraid of the Dark" for some experts' perspectives on night flying. But these perks come with unique challenges and risks, including limited visibility. During nighttime operations, pilots can fall victim to optical illusions that drastically compromise their safety. So, let's shine a light on the types of illusions that you might encounter at night and what to do to combat them.



#### **Sight Without Vision**

During flight, visual reference is the most important contributor to accurate spatial orientation. By using visual references, the pilot can gather information about distance, speed, and depth. Any condition that deprives the pilot of natural visual references can rapidly cause spatial disorientation (spatial D). These include darkness, the focus of this article, along with clouds, fog, haze, terrain, and sky backgrounds with indistinct contrast (i.e., arctic whiteout or clear, moonless skies over water). Humans are visual creatures; our bodies are not built for flying and all the sensations that go with it. Without adequate visual cues, you can easily be fooled into thinking that you are climbing when really, you're accelerating downwards. Additionally, if you're turning steadily without adequate visual cues, after a while you can easily be fooled into thinking that the turning has stopped and stabilized when the turning is still ongoing. In fact, after rolling to straight-and-level, a turn in the opposite direction can be incorrectly perceived and quickly turn into a nightmare.

NTSB data suggests that accidents involving spatial D are more common at night or in limited-visibility weather conditions. Since 90% of spatial D accidents are fatal, it's vital that pilots are aware of the dangers of losing their bearings.

So, what should you be on the lookout for when it's dark and the looking is difficult?



The black hole effect.

#### **Autokinesis**

This illusion happens when a pilot stares at a bright, stationary light set against a pitch-black background, such as a star, a planet, or the light from another aircraft. After a few seconds, the light could appear to be moving toward the aircraft. You may have even experienced this illusion on the ground. Autokinesis occurs because motion perception is always relative to some fixed reference point, and in a dark sky, there are few, if any, reference points so the position of the single point of light is undefined. In an attempt to avoid the impending "collision," you may become disoriented, thinking you have shifted off course relative to the reference point. To prevent this illusion, avoid staring at one point of light for more than a few seconds and remember to conduct a systematic scan for traffic.

#### **The Black Hole Approach**

On a daytime approach or even a night approach over a well-lit area, you can use peripheral visual cues to confirm your glide path throughout your descent. You have feedback on your position relative to the runway. But on dark nights, approaching an airport with few lights or identifiable ground features can create the illusion that the aircraft is at a higher altitude than it actually is. The resulting black hole effect may cause you to come in with a too-low approach. Drawn in by the darkness, you may crash before reaching the runway.

The black hole effect can also occur when taking off from a brightly lit airport into a pitch-black, featureless sky. With no visual cues to reference, you can experience vertigo and disorientation. Training for the black hole effect, in a simulator and in flight, is the best way to prepare for this situation. Additionally, always trust your flight instruments to maintain orientation and a stable approach. Use visual aids such as a Visual Approach Slope Indicator (VASI) or Precision Approach Path Indicator (PAPI), instrument approach if trained and available, and consider landing at a well-lit alternate. You can also discuss possible hazards with local pilots that are familiar with the airport.

#### **False Horizons**

Another potential danger is seeing something you think is the horizon and orienting yourself with it. During the day, you can simply align with the natural horizon of the earth to maintain straight-and-level flight. But on dark nights when there's no visible horizon, the brain can still trick itself into searching for a horizon to reference. For example, a sloping cloud formation, bright stars, or ground lights from a highway can create the illusion that the aircraft is



An example of a false horizon illusion.

not aligned with the horizon. Using these references, you may align with an incorrect horizon and enter a dangerous attitude. To prevent this illusion, you should cross-check with the aircraft's attitude indicator. It won't be fooled by clouds, stars, mountainous or hilly terrain, and city lights.

#### At night, an upward-sloping runway or terrain can create the illusion that the aircraft is higher than it actually is.



#### **Flicker Vertigo**

Flicker vertigo is an imbalance in brain-cell activity caused by exposure to the low-frequency flickering (or flashing) of a relatively bright light (e.g., a rotating beacon or a strobe light). Flicker vertigo can lead to incapacitation and loss of control of the aircraft. Although not technically an illusion, flicker vertigo is often cited as such because it can result in spatial disorientation. Symptoms often occur among helicopter pilots; however, pilots of fixed-wing and propeller-driven airplanes and crewmembers and passengers can also experience the effects. If you start to experience flicker vertigo, look away from the light source causing the vertigo and the symptoms should subside. Flicker vertigo, which is not confined to night operations, is usually more of a minor irritation than a source of severe impairment to most pilots.

#### **Head-up Illusion**

Another night-flying illusion that can occur during takeoff is the head-up illusion. As your eyes transition from the bright lights of the airport to the relative darkness of the sky, you may suddenly feel that the nose of your plane is pitching up more than it should. Aircraft acceleration exacerbates this phenomenon. At zero acceleration, the vector of gravity is straight down. As you accelerate, the vector shifts slightly behind you, causing you to feel like you're starting to pitch up even before you rotate. As you pitch up to climb out and continue to accelerate, the feeling only intensifies. Your instinct would be to correct this by pushing the stick forward and lowering the nose, but if you are experiencing a head-up illusion, this action could cause a crash. As with other illusions, be aware of the potential and crosscheck what you are feeling versus what your instruments are reading before making any input corrections.

An example of sloping runway illusions.

#### **Sloping Terrain Illusions**

At night, an upward-sloping runway or upward-sloping terrain can create the illusion that the aircraft is higher than it actually is. To compensate, you might fly a lower-than-normal approach, which could lead to a controlled flight into terrain accident. A down-sloping runway or down-sloping terrain can have the opposite effect, resulting in flying a higher-than-normal approach. When planning your route, consult the appropriate U.S. Chart Supplement for diagrams and information on a runway's slope, terrain, lighting, and availability of visual glideslope indicators. If your aircraft is equipped and the runway is served by an instrument approach with vertical guidance such as an Instrument Landing System (ILS) or Wide Area Augmentation System with Localizer Performance with Vertical guidance (WAAS LPV), make use of the glide path, even when approaching the airport VFR.

#### The Night in Nightmare

On Jan. 22, 2005, an instrument-rated pilot of a Beechcraft *Bonanza* and his passenger were killed when they crashed on final approach at Brownwood Regional Airport in Brownwood, Texas, during dark night conditions.

The flight departed Dallas Executive Airport on an instrument flight rules (IFR) flight plan to Brownwood. Upon arrival, the pilot was cleared for a visual approach to Runway 35. While descending into the airport, the Bonanza hit power lines and trees before striking the ground. Witnesses heard the airplane overhead and then a loud explosion. One witness noted that the airplane was at about 500 feet above ground level, three miles south of the airport, and heading north.



The weather at Brownwood was reported as winds 360 degrees at 9 knots, visibility 10 statute miles, sky clear, temperature 57 degrees F, dew point 45 degrees F. Witnesses to the accident said that it was dark, the sky was clear, and the winds were calm.

After the accident, the investigator conducted a test, with the help of the local fire department, to see if the pilot could have seen the runway from the point where the *Bonanza* hit the wires. On a night with moonlight and weather conditions similar to those at the time of the accident, the investigator used a ladder truck to raise numerous firefighters to the height of where the airplane hit the wires. All indicated that at a height of 40 feet, the airport was clearly visible, but many thought they were 150 to 200 feet above the ground. Because of a lack of lighting and sloping terrain, they experienced the black hole illusion with no visual horizon.

The NTSB determined that the cause of the accident was the pilot's failure to maintain proper altitude and clearance while on final approach. Contributing factors included the pilot's lack of familiarity with the airport, the light conditions, the lack of a visual approach glide slope indicator, and spatial disorientation.

#### Good Night

When my daughters were anxious about going to sleep, I would check in their closets and under the bed to show them that there was nothing to be afraid of. But when it comes to night flying, seeing is not always believing. Flying at night can be incredible, but remember that darkness does not discriminate, and pilots of all skill levels are susceptible to these illusions. If you encounter a visual illusion while flying at night, the solution is almost always to trust your instruments, not your eyes.

Nicole Hartman is an FAA Safety Briefing associate editor and technical writer-editor in the FAA's Flight Standards Service.

#### LEARN MORE

Spatial Disorientation Visual Illusion brochure (PDF) bit.ly/4f3aicT

GAJSC Spatial Disorientation fact sheet bit.ly/SDFactSheet

Aeronautical Informational Manual (AIM), Chapter 8 bit.ly/AIMweb

Instrument Flying Handbook, Chapter 3 bit.ly/43H2Ygx

#FlySafe GA Safety Enhancement Topic: Vestibular Illusions bit.ly/4folhNj



# 57 Seconds to Safer Flying





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# **A New Look for Night Lights**

An Update on the FAA's Approach Lighting LED Migration Plan

#### By Tom Hoffmann

While it may have taken some time for U.S. consumers to warm up to the many benefits of LED lighting, it's clear that this more efficient technology is here to stay and is growing at an impressive clip. According to the U.S. Energy Information Administration, the percentage of households that use LED lighting for most or all of their indoor lighting rose from 4% in 2015 to 47% in 2020. There's been an increase in LED use in many commercial and industrial applications as well, including office buildings, parking lots, stadiums, and more. A lot of that increase is due to lower LED costs, the shrinking availability of non-LED light bulbs, and the realization of this technology's many benefits, such as longer bulb life, lower usage costs, and enhanced light quality.

Of course, LEDs offer similar benefits to the aviation industry as we've noted in the articles "Change the Light Bulbs" (bit.ly/LEDtechnology) and "Nightlights" (bit.ly/FAASB\_NovDec15 (PDF)). But unlike many industries employing LED technology, it's not always as straightforward as unscrewing and replacing bulbs in the aviation sector. There are specific safety and viability factors the FAA must consider, such as bulb brightness, color conspicuity, and visibility variations that may exist in different low-visibility environments. To address these issues, the FAA invested in a significant amount of testing and research to ensure all LED replacements can be installed and operated safely. That hard work has paid off with the agency now ready to move forward with its plan to get LEDs installed in approach lighting systems (ALS) nationwide. Let's look at how we got here and shed some light on what's in store for the future.

#### LED technology offers many benefits, including longer bulb life, lower usage costs, and enhanced light quality.

#### PAR for the Course

The LED transition effort began back in 2007 under the direction of the Energy Independence and Security Act. This act mandated improved light bulb efficiency and required the FAA to transition incandescent lamps to LED technology within the various ALS arrays, namely the PAR 38 and PAR 56 bulbs used in these systems.

For those wondering, PAR stands for parabolic aluminized reflector. As the name implies, these bulbs use a highly reflective aluminum coating in a parabola-shaped housing that helps create a focused beam of light. You'll likely find this design with many accent, landscaping, and stage lighting applications. The number refers to the size of the bulb in one-eighth-inch increments, so a PAR 38 bulb is 4.75 inches wide and a PAR 56 is 7 inches wide.

The larger PAR 56 bulbs are used with the more sophisticated High-Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2), which is only found at roughly 150 airports. The ALSF-2 uses a mix of more than 250 steady and flashing lights that extend out 2,400 feet from the runway threshold to provide visual information on not only runway alignment, but also height, roll, and horizontal reference for Category II/III precision instrument approaches. The ALSF-2 system also includes a high-intensity flasher system known as a "rabbit," which looks like a giant ball of light sliding toward the runway two times per second. (Note: The PAR 56 LED replacement is still a work in progress given the added complexities and scrutiny the ALSF-2 systems demand.) More on that a bit later.

#### The FAA is moving forward with its plan to get LEDs installed in approach lighting systems nationwide.

PAR 38 bulbs are mainly used with the ALSF-2's smaller sibling — and quite possibly the FAA's lengthiest acronym — the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). With 940 locations, this is the system you will more likely encounter. MALSR uses threshold lamps, light bars, and flashers to provide guidance for Category I approaches.

A typical MALSR uses 18 green PAR 56 lamps along the runway threshold spaced 10 feet apart, nine white light bars with five lights separated every 200 feet, and five sequenced flashers also separated every 200 feet over a distance of 2,400 feet from the runway threshold. At the 1,000-foot point, there are three light bars (15 lamps) for added visual reference for the pilot on final approach. Sequenced flashing lights provide added visual guidance down the runway centerline path.

#### A Literal Light Bulb Moment

The FAA has long considered using LEDs to replace the less efficient incandescent lights in the ALSF-2 and MALSR systems to improve reliability and reduce maintenance. Early operational field tests with MALSRs at Phoenix Sky Harbor International Airport and Grand Forks International Airport were very encouraging. However, the FAA decided to research a few issues further.

One area the FAA reviewed was flicker. "LEDs can blink or flicker since they are not a steady-state light," says Matt Harmon, an aviation safety inspector with the FAA's Flight Technologies and Procedures Division. "After extensive research, we were able to eliminate LED flicker by varying



Lighting configuration for the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR).

pulse width modulations and voltage inputs, which can change the way your eyes perceive the light."

These pulse width modulation adjustments were also used to better control dimming with LED bulbs, addressing the issue of excessive brightness that concerned some pilots early on. When it comes to dimming, Harmon is quick to point out another unique advantage of LEDs — no color shifting. "LEDs stay the exact same color all the time, whereas a white incandescent might appear yellower as it dims."

#### **Play It Cool**

Although rife with operational advantages, there is one LED benefit that wound up being a liability in certain cases. Hand in hand with an LED's greater efficiency comes a drop in the heat produced per watt. In fact, LEDs emit nearly 100% of their energy as light, compared to incandescent light, which can waste as much as 98% of its energy as heat. However, the lack of heat — and heat in the form of infrared radiation (IR) — will not allow some legacy night-vision goggles (NVG) and enhanced flight vision systems (EFVS) to detect these lights on their display.

The agency changed specifications in 2020 to add IR emitters to red LED obstruction lights (see Advisory Circular 70/7460-1M), however, the requirement to have an electronic means to see approach lights if you can't see them with your naked eye will not change (Title 14, Code of Federal Regulations (14 CFR), section 91.176 (a) and (b)). NVG and EFVS manufacturers are working on adopting new technology that can better detect LED lights. In the meantime, the FAA is planning to start charting LED approach light installations in the U.S. Chart Supplement to help EFVS users know where to expect LEDs. The change is expected to take place with the December 2024 chart cycle. In addition, FAA's Flight Standards Service has a spreadsheet of all LED approach light system locations at bit.ly/LED\_Installations (PDF).

#### Lighting the Way

With several years of research under its belt, the FAA is now well on its way to installing LEDs at ALSs nationwide. "We have awarded a contract to a company to develop production units of PAR 38 LEDs, and we're now in the final phase of development tests," says Donald Lampkins, project lead with the FAA's Visual Guidance Lighting Systems Group. "We should be through the testing phase by next April and ready to install at different airports by the end of September 2025." While the timeline for completion is predicated on funding, Lampkins expects to have the MALSRs all transitioned to LED within six to 10 years.

"With MALSRs, we don't have to change any of the infrastructure," Lampkins continues. "We are able to swap out the existing lamps with LED ones." The new FAA specification for MALSR lights is fairly similar to the previous specification for incandescent lights, with the exception of some voltage requirements and a few other items specific to LEDs. "This keeps it a simple replacement for 98% of the system. We were able to achieve this by using a new smart LED lamp that can detect the different voltage requirements and provide the correct light output for each section."

The higher-intensity ALSF-2 systems, on the other hand, have presented a few additional challenges for LED transition. Lampkins notes that these lights demand higher scrutiny and more certification parameters given the different architecture and the extremely precise Category II and III approach systems they support.

"Lamps within an ALSF-2 have different requirements and must work within a constant current-based lamp monitoring system, so it's more complicated. The good news is that we can use all of the hard work and lessons learned from the MALSR lights research to help write the specifications for ALSF-2." The FAA's ALSF-2 Project Team is currently working on those details, along with finding a bulb supplier, and expects to have a solution in place within three to four years.

#### Many Hands Make Light Work

Coordination is key when it comes to the actual installation of the new approach light LEDs. The FAA's MALSR Project Team schedules the replacements according to available funding and resources and will try to coincide with other planned airport maintenance activities to limit operational downtimes. With MALSRs, there are approximately 63 bulbs to replace in lighting rows spaced out 200 feet and within a 2,400-foot footprint. "A single MALSR can take anywhere from two hours to two days to complete," says Lampkins. Factors such as terrain and accessibility, including whether any lights are located within a runway safety area, can affect the schedule.

It's also worth noting that the FAA does not plan to install approach lighting LEDs piecemeal. This is to comply with existing requirements that direct airports to convert to LED lights on a single runway or taxiway at the same time to avoid any visual perception differences for pilots. That said, there is the potential to see LED lights on the airfield (e.g., runway centerline lights, taxiway lights) along with incandescents used for approach lighting before the transition is complete.

#### A Happy PAPI

MALSRs and ALSF-2 systems are not the only approach aids in store for an LED makeover. Also included in the replacement schedule are the Precision Approach Path Indicators or PAPIs. A PAPI consists of four light boxes arranged perpendicular to the edge of the runway. It projects a pattern of red and white lights that provide visual approach slope information.

A key difference with the transition to LED PAPIs is that existing PAPI units will be completely replaced instead of just changing the bulbs. Currently, the priority is to use PAPIs to replace the older Visual Approach Slope Indicator (VASI) systems. These more antiquated systems with numerous variations are approaching 60 years old. As such, VASIs have become increasingly unreliable, with spare parts becoming harder to find. The FAA also adopted this change to conform to International Civil Aviation Organization (ICAO) requirements that use PAPI as the new international standard for visual glide slope indicators.

"We still have about 400 VASIs out there," says Lampkins, whose efforts are helping direct about 20 replacements a year with new LED PAPIs. There are currently 1,356 PAPI systems in the National Airspace System (NAS), 139 of which have LEDs. There's still a long way to go to have everything fully updated with LEDs, but there's a strong incentive to get it done soon due to market forces that have driven manufacturers away from producing incandescent lamps.

Also fueling the drive for replacement are the impressive power consumption savings that the switch to LED provides. "When we replaced VASIs with LED PAPIs we noticed a 60-70% reduction in power consumption from the old units, which translated into significant cost savings." It was these cost savings that led the LED PAPI Program to win the Department of Transportation's 2023 Sustainability Award. Lampkins expects that the MALSR LEDs will have similar



FAA technician performing maintenance on a PAPI light box.



Check out this video (bit.ly/4fR4AuK) that shows a side-by-side comparison of LED versus incandescent PAPI lights in use.

power savings, going from 14,000 watts to just 4,000 watts to operate. An even greater savings may be realized in the future with the much more power-hungry ALSF-2 lamps.

#### **Passing with Flying Colors**

In addition to heeding the advice of researchers about LED use, the FAA is also keenly focused on pilot feedback. "We're seeing a lot of the same positive feedback from before in recent years," says Harmon. "Pilots have indicated that the LEDs work well, can be easily spotted in bad weather, and that they're able to detect color differences." He admits that while the volume of overall feedback is down, that's to be expected as LEDs have become more the norm in the NAS.

Lampkins adds that the transition has been "a positive change for pilots that will definitely improve visual cues."

This feedback, coupled with numerous financial and environmental benefits, paints a bright future for LED technology and helps solidify its successful role in the NAS.

Tom Hoffmann is the editor of FAA Safety Briefing. He is a commercial pilot and holds an A&P certificate.

#### LEARN MORE

FAA's Visual Guidance Lighting Systems web page bit.ly/FAA\_VGLS

FAA Engineering Brief 67, *Light Sources Other than Incandescent and Xenon for Airports* **bit.ly/Eng\_Brief\_67** 

SAFO 18010, Procedures for Avoiding Obstacles Lighted with LED Obstruction Lights While Utilizing Night Vision Goggles bit.ly/SAF018010

AC 70/7460-1M, *Obstruction Marking and Lighting* bit.ly/AC70-7460-1M (PDF)

FAA Report AM-22/08, *LEDs in Airfield Lighting Applications* bit.ly/FAAReport\_22-08 (PDF)

# **DEVELOPING YOUR NIGHT FLIGHT PLAN** A Guide to Avoid Things That Go Bump in the Night

Article and photos by William E. Dubois

ight flight is wonderful. It offers the beauty of sparkling carpets of city lights and moon-drenched landscapes, calm air, tame weather, uncrowded skies, and light radio traffic.

But — perhaps — danger lurks in the darkness, just over the horizon.

The AOPA Air Safety Institute's *Night Flying Accident Analysis Report* found that while night flight makes up a relatively small percent of total general aviation (GA) accidents — about 7% — they are disproportionately fatal, accounting for 16% of all fatal GA accidents. Worth considering, when absorbing this statistic, is that those numbers aren't adjusted for the fact that a lot less GA flying — only 8 to 10% historically — occurs at night. The bottom line is that night flight has the potential to be considerably more hazardous than the numbers suggest at first glance.

In the grim list of accident causes detailed in the report, controlled flight into terrain (CFIT) comes in at fifth place among the 27 causes of night accidents and is notable for being the most fatal defined type of night accident — only being outstripped in un-survivability by the "unknown cause" category. Night CFIT numbers are a big enough concern to the NTSB that they issued a safety alert (SA-013) over the issue in 2008 and updated it again in 2015. The alert, *Flight Into Terrain in Visual Conditions* features a flaming red subhead that reads: "Nighttime Visual Flight Operations are Resulting in Avoidable Accidents."

While certainly sobering on one hand, the positive takeaway is that these accidents are deemed avoidable, and there are a number of steps you can take — both before and during night flight — to dramatically reduce your personal risk and avoid becoming a statistic.

#### Preflight

The NTSB's safety alert states that CFIT accidents can best be avoided in the preflight phase of flight. With that in mind, how can you enhance your pre-night preflight for maximum CFIT avoidance?

#### **Preflight Altitude Selection**

When it comes to avoiding controlled flight into terrain, the first step is to recognize that you may or may not be able to see all of the terrain you want to avoid. Your top priority for a safe night flight is to choose an enroute altitude well above anything that you might smack into in the dark. This includes terrain, wind farms, and cell phone towers. Check the blue maximum elevation figures (MEFs) for each quad — and adjacent quad — of the chart along your route and select an altitude high enough to ensure comfortable clearance above those numbers. That will take care of most enroute CFIT risk, assuming you fly with even modest skill when it comes to staying on course and on altitude. But while you're looking at the chart, take the time to really study the terrain features along your route. What type of terrain are you flying over? What is on either side of your course? Be especially alert to hills or other features that rise significantly above the average terrain and be on the lookout for the blue "Eiffel Tower" icons that indicate obstacles that rise 1,000 feet above ground level. Some of the tallest cell towers can top 2,000 feet. Altitude, always the pilot's friend, is even more so when the terrain is cloaked in a coat of darkness, so give yourself plenty of it.

#### **Preflight Route Considerations**

Also, take a look at the distribution of cities along your route. The "yellow zones" around cities and towns on the chart are not the imprint of city lights but are instead the visual outline of development around a populated area — the footprint of human activity on the natural terrain. Still, these markings can be used as proxies to indicate areas of considerable ground lighting and the accompanying night horizon-identification factor that a well-lit ground environment provides. On the other hand, in chart areas more devoid of development markings, consider that ground lights may be sparse, and maintaining a visual reference to the horizon may be difficult, or on non-moonlit nights, impossible.

Night visual flight rules (VFR) flights over rural areas can be considered an exercise in maintaining control by reference to instruments. If your comfort in panel-based orientation is less than 100%, consider charting a pilotage course across rural areas that follows major highways instead of a direct-course magenta line across the countryside.



A 1947 Erco 415-D (Ercoupe), formerly William Dubois' family airplane, sitting on the tarmac at Santa Rosa Route 66 Airport (SXU) as night approaches.

#### **Preflight Thinking About Airports**

Take the time to carefully study the approach paths to all runways at your destination and alternate, with an eye toward terrain and obstacle issues that could provide a hazard to flight if invisible or obscured by darkness on approach. And, while you are studying the airport environments, grab the Chart Supplement and ensure that fuel is readily available after hours at any planned refueling stop.

#### Preflight Nocturnal Weather Briefing

Moving from route planning to weather briefing, your weather check should include both the phase of the moon (the more moon the better if flying over rural areas) and the presence of high-altitude cloud cover. While we might normally ignore a ceiling well above our flight altitude, when it comes to night flight, a high ceiling can block out moonlight as effectively as closing blackout curtains at home to silence an annoying streetlight.

Finally, when checking Notices to Air Missions (NOTAMS) for day flights, we tend to tune out the plethora of "obstacle tower light out of service" alerts — but now those should be of the keenest interest to you.

#### Departure

You can maximize safety on departure by treating a night takeoff as a quasi-instrument maneuver. Expect to be more "head down" than during a normal daylight takeoff. And even if not instrument rated, with proper knowledge and training, you can steal some moves from the instrument pilot's playbook. Take a look at the instrument departures for your airport to see how instrument traffic would be safely routed up, out, and away from the airport. How does your departure plan compare? Simply taking off and proceeding on course like in the daytime may not be the safest departure.

#### Enroute

It's back to basics for the enroute segment at night. Ensure you update your altimeter for local pressure frequently as you travel across the dark landscape to ensure your altitude is actually what you think it is. And challenge yourself to maintain that altitude — and heading — with good ol' fashioned military precision, if you can. If you are receiving VFR radar services, a.k.a. "flight following," remember that the radar is designed for traffic, so don't count on air traffic control (ATC) to let you know that you are about to smack into a grove of tall trees atop a hill.

#### **Approach and Arrival**

Any night arrival requires strong airmanship with enhanced altitude precision, especially in the approach to landing phase. When in doubt, assuming the runway length is sufficient, stay high and land long. If you are flying on an instrument flight plan, recall that while your approach keeps you clear of obstacles and terrain until minimum descent altitude (MDA) or decision altitude (DA) — after that, all bets are off. As designed, you are supposed to continue to the touchdown visually after MDA or DA. Popping out of the clouds and having a clear sight picture in daylight is all good and fine but consider that at night — even without clouds — there can easily be invisible terrain or obstacles nearby. Continuing nonchalantly down a darkened glide slope is not a guarantee of obstacle clearance.

#### **Night Proficiency**

While you could, in theory, do an entire course of training for a private pilot certificate at night (there is no day flight requirement in the regs), most pilots in training only rack up the required minimum of three hours, and many flight schools combine those hours with the required "hood" time (foggles to you younger pilots), meaning that many trainees are never really exposed to proper VFR night flight. On top of that, most GA pilots don't fly at night that often.

Speaking of the hood, as there are a host of night illusions that put night fliers at risk of spatial disorientation (see "Your Senses in the Shadows: Nighttime Visual Illusions and Spatial Disorientation" in this issue), some regularly scheduled sessions under the hood with a flight



A rainy night at Great Bend Municipal Airport (GBD) in Kansas.

instructor is a valuable investment. Many countries require a night endorsement with more robust training for night flight, so why not create your own as a personal minimum?

And ironically, as the "runway lights" do nothing to light the runway, but rather illuminate its outline so we can visually judge our approach height and angle, it just feels a lot different landing at night. If you're flying solo, there's no night proficiency requirement. But if it has been a while, it's a good idea to go up with an instructor or night-current safety pilot and get in some local practice before a night cross-country flight.

#### Gadgetry

Today's pilot has a huge situational awareness advantage over pilots of previous generations. Any tablet computer, running an app that costs less per year than one hour of flight time, has a major feature that can enhance night safety when properly used: alerts related to terrain and obstacles. Of course, these are only useful when both properly understood and activated. The second major feature many apps boast deserves a word of caution, and that is "synthetic vision." Synthetic vision appears to act similar to night vision goggles, but it is not at all the same, so don't you dare fly it that way. It's all computer modeling based on GPS location and stored databases. And trees, you know, grow.

Still, synthetic vision and terrain and obstacle alert features, while not primary flight tools, are useful enhancers of situational awareness and great resources for added safety.

#### **Boot up the Night**

Speaking of tech, even the most modest flight simulators can be used in night mode. Close the curtains, turn off the overhead lights, and practice some night approaches into challenging airports — you know, the ones in the mountains or surrounded by trees.

#### The "V" in VFR

Consider that the "V" in VFR stands for visual, but night limits our vision in multiple ways. Our eyes shift from cone-mode to rod-mode, our central blind spot expands, and our brains are capable of manufacturing all manner of visual illusions to compensate for our lack of visual acuity.

Meanwhile, VFR flying is more heavily reliant on being able to see than most pilots appreciate.

The key, beyond intelligent flight planning for night factors, is to fly fully aware of your night-imposed visual limitations. Rely more heavily on your instruments than you do during the day, and program your mind to let the instruments rule the night — should your eyes and your instruments disagree.

Oh, and speaking of the rods, those little suckers are absolute oxygen hogs due to their high metabolic rate at

night, the primary reason that the FAA recommends the use of supplemental oxygen at night at altitudes above 5,000 feet mean sea level (*Airplane Flying Handbook*).

#### Human Factors, Night Edition

And finally, don't underestimate the corrosive effect of fatigue on both fine motor skills and mental processing speed. If you are tired, you won't fly as well as when you are well-rested and your mind will take longer to figure things out. Descending from cruise at night, the airport in sight suddenly flickers and winks out. How long will it take your tired brain to process the fact that something solid is now between you and a safe landing?

Many night GA flights follow a "normal" workday, and while this may be unavoidable, a good mitigation is to schedule a preflight cat nap. It will be considerably more effective than coffee, an energy drink, or a caffeinated soda; any one of which — all being diuretics — can trigger another unwelcome human factor that can add to night stress.

#### Wrap Up

Still, there's no reason not to enjoy the calm beauty of the night. It's a fine time to fly. It simply requires a bit more focus on preflight, a change in some day-habit procedures, increased awareness of your physical condition and limitations, and attention to precise flying.

Be sure to rely heavily on your instruments for departure, fly with precision enroute, and maximize situational awareness on arrival. Deploy your gadgets and work on your night proficiency training in an airplane and simulators. Finally, always be alert to the fact that while humans are not naturally nocturnal, with the right tools and precautions, we can indeed master the night.

William E. Dubois is the ground school program manager for Infinity Flight Group and a widely published aviation writer. He holds a ground instructor certificate with all ratings, a commercial pilot certificate with instrument rating, and is a dual-accredited Master Ground Instructor. He loves night flight.



# Don't Be Afraid of the Dark

Practice, Preparation, and Proficiency for Safe and Enjoyable Night Flights

By Rebekah Waters

<sup>2</sup>hoto by Paul Hamilto

othing beats the peace and serenity of a night flight. Cruising through the night sky after dark is a beautiful experience. But night flying comes with some inherent risks that might make you afraid of taking off after twilight. Is it worth it to overcome this fear? Absolutely! For starters, limiting your flights to daytime only cuts down the hours you can operate. Those of us that live in the United States have entered the season of shorter days and longer nights, so the hours in a day available for flying have decreased significantly if you aren't flying at night.

#### Things that Go Bump in the Night

There are many scary stories of incidents and accidents at night: from close encounters with terrain to accounts of pilot-controlled airport lighting not turning on because older radio frequency technology didn't work correctly! Engine failure isn't more likely to happen at night, but when it does, finding an open place in the inky blackness below for a safe forced landing isn't an easy endeavor. During the day, you can spot bad weather from miles away, but at night, it can sneak up on you seemingly all at once. With the countless challenges and risks presented by night flying, you might wonder why this fear is worth conquering.

#### **Unmatched Peace and Serenity**

To start with, night flying opens up more opportunities for travel. Not only will you have more hours available for flying, but when you fly at night, the airspace is usually less congested. Airspace tends to open up and become easier to navigate at night. Less congested airspace also means fewer radio calls. The pilot who can fly at night is a pilot who can truly enjoy the solitude of flight without the distractions of air traffic more common in the daytime.

In addition, flying at night can give you a a fresh perspective on landscapes, cities, and landmarks that you've flown over during the day. Everything looks different in the dark, but instead of being scary, it can be a new way to appreciate the terrain below. The contrast between the dark sky and city lights, especially along coastlines or over large cities, can be breathtaking.

Weather can often be better at night too, adding to the peace and serenity of night flights. During the day the sun heats the earth's surface, causing air to warm and rise. This creates thermal currents and updrafts that can lead to turbulence — especially over mountains, large bodies of water, or uneven terrain. At night, after the sun sets and the air cools, the atmosphere tends to be more stable especially at lower altitudes. Cooler air is also denser. This helps to prevent the rising of warmer air masses that might otherwise lead to convective turbulence, and smoother air means less turbulence than daytime flying. At night, winds are likely to be lighter, temperature changes are likely to be fewer, and thunderstorm activity is likely to be reduced. You are left with flying conditions that are more conducive to a smoother and more enjoyable flight.

The pilot who can fly at night is a pilot who can truly enjoy the solitude of flight without the distractions of air traffic more common in the daytime.

#### **Adventure is Out There**

Flying at night can feel like a new frontier. Even familiar routes might feel like uncharted territory. And when you're flying far from the lights of large cities, you might be treated to spectacular celestial views of planets, or maybe even the northern lights.

For pilots who are looking to challenge themselves, night flying is where it's at. Night flying demands sharp decision-making skills, careful planning, operational discipline, and risk management. Embarking on the adventure of night flying can increase your overall proficiency and confidence as a pilot.

#### Practice, Preparation, Proficiency

If you've read this far, I hope you have been convinced that overcoming the fear of flying at night is worth your while. To bring you the best tips on how to safely enjoy flying after dark, I spoke to two night flying experts: Paul Hamilton and Bob Raskey.

They both note that overcoming a fear of flying at night begins with practice. Find and practice with a flight instructor who has a lot of good night flying experience. Practice things unique to night flights, like dimming and raising panel lights, identifying changes in the weather, and forced landings. Building your confidence with scenarios like these while you have an instructor in the seat next to you is a good way to chip away at your fears.

Hamilton, a seasoned pilot with 38 years of flying experience, still remembers his first night flight.

"It was a required part of my private pilot training, in September of 1986. It was a local flight out of Gaithersburg, Md., [GAI]. I recall how different the sight picture was in a night landing. The flight school did not allow student pilots to make night solos, so my first time alone in the night sky was March 11, 1987, a few weeks after getting my private certificate. I started my instrument rating right after and most of my training was at night, so I had 8.2 night hours by then. I logged 2.4 hours that night, practicing takeoffs and landings and enjoying the beauty of the night." While Hamilton never experienced anxiety about flying at night, he points out that the percentage of fatal accidents is a good deal higher at night. For him, practicing flying at night helps him to mitigate the risks to acceptable levels.

"The first step is to recognize that night adds risks, so some fear is appropriate. Like many things, fear is good for you, in moderation. At night, most of us are low-time pilots. I may have just short of 8,000 total hours, but I'm only just a 1,000-hour night pilot. According to Paul, logging some practice with a night-proficient instructor is among the best ways to dispel any nocturnal nervousness.

Raskey was working on helicopters in the National Guard when he got the urge to learn to fly. Because of his day job, most of his flight training happened after sunset. He thinks this is why he's always felt comfortable flying at night. Like Hamilton, he too advises pilots who want to overcome a fear of flying at night to practice with a seasoned flight instructor until the fear starts to subside.

"I was taught by really good instructors. Learning to fly at night made me comfortable with it, and I love it to this day. The serenity of the sunsets is beautiful," Raskey told me. "Night flying has its beauty as well as its treachery." He recommends studying and practicing things like increasing your spatial awareness and adjusting your eyes to the dark to diminish the risks of nighttime flying.

Both Raskey and Hamilton emphasized the importance of practicing simulated emergencies at night. While engine failure at night is not more likely, it is scarier, and the visual references are different. The same goes for the loss of lights. Practice handling simulated emergencies at night so you will be ready to do what's necessary to stay safe should an emergency arise. "We gain confidence by offsetting the added risks of night with practice and other mitigations," said Hamilton.

#### Tasks like preflight inspections and weather briefings are even more important at night.

In addition to practice, Raskey and Hamilton both agree that preparation is key. Before you take off, there are many things to consider. Tasks like preflight inspections and weather briefings are even more important at night. Knowing the cycle of the moon and what airports shut down at night or turn off their lights is also important. Fuel management, while always important, can be even more important at night. Things like diversions to an alternate airport or an issue with the plane that necessitates a forced landing without visual cues make sufficient fuel reserves absolutely necessary. "Be much more conservative at night. Go through a night safety checklist. Study the charts and don't stretch your limits," states Raskey.

Inside the cockpit, make sure you have multiple flashlights — including one that can shine red light to save your night vision. If your flight plan is on a tablet, adjust the brightness for nighttime or use a night-sight app. If it's on paper, remember not to use highlighters since they can make it impossible to see what you highlighted in the





cockpit's dim light. Make sure that you know how to turn the lights on if you are going to land at an airport with pilot-controlled lighting. Always have a plan, and a backup plan in case anything goes wrong.

Proficiency is yet another key to mastering the night sky, and it's more than just staying current. While currency means you have met the legal requirements to fly at night, proficiency means you are fully competent. Becoming a competent night flyer will help give you the confidence you

#### Night flying demands sharp decision-making abilities, careful planning, operational discipline and risk management.

need to feel comfortable in the evening skies.

The more hours you log at night the more competent you will become as a night flyer. When you are building up your night flying skills, there are a few things you can do to make it easier. Begin by using a familiar plane. Muscle memory for controls like dimming and maximizing the instrument panels goes a long way in ensuring a smooth night flight. Stick to familiar routes. Start off flying a route you've flown so often in the daytime, that you almost feel like it's second nature to you. As you become proficient at night flying, your confidence will build, and your fear will shrink. Start the flight while it is still daylight, so you have the opportunity to slowly transition into night operations.

"Frequent night flying increases your confidence and helps you increase your ability to do the right thing in tough situations," said Raskey. "But make sure you stay in the confidence sweet spot — not too low, but also not too high. Don't let overconfidence make you take risks or stretch your limits."

There's something special about flying at night. City lights twinkle below you, and stars shine bright above. It is a peace unlike anything daytime flying has to offer. So don't let a fear of nighttime flying make you miss it. With enough practice, preparation, and proficiency, there's no reason to be afraid of the dark!

Rebekah Waters is an FAA Safety Briefing associate editor. She is a technical writer-editor in the FAA's Flight Standards Service.

#### A CRITICAL TRANSITION FOR AVIATION

Eliminate Aviation Gasoline Lead Emissions (EAGLE) Fall 2024 Update

The aviation community has long recognized the need to eliminate lead emissions from piston-engine aircraft. The Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative, led by government and industry partners, aims to achieve this goal by the end of 2030. This ambitious endeavor brings together government and industry stakeholders committed to finding a safe and reliable unleaded aviation fuel that is viable throughout the aviation supply chain.

As the general aviation community works toward this goal, the role of aircraft owners cannot be overstated. They are, after all, the ultimate end-users of any new fuel, and their buy-in will be critical to its success.

This transition is about more than meeting regulatory requirements it's about ensuring that aircraft owners feel confident in the safety, reliability, and availability of the new fuel. The solution must be robust enough to meet the diverse needs of the piston-engine fleet, ranging from World War II-era planes to modern helicopters.

Currently, there are three promising unleaded fuel candidates. Their developers are pursuing either the Fleet Authorization (FA) under the Piston Aviation Fuels Initiative (PAFI) or the traditional Supplemental Type Certification (STC) process via an approved model list (AML). Both pathways ensure that engines and aircraft can safely operate on the new fuel however, regardless of the path to approval to use in aircraft, consumer acceptance will hinge on more than FAA approval.

Fuel developers must not only prove their products' safety and compatibility with the existing fleet but also demonstrate to key industry stakeholders that their products are reliable. Aircraft owners need assurance that switching to a new fuel won't void manufacturer warranties. They also need to be confident that it won't cause damage to paint, electronics, engine components, or fuel systems. The aviation supply chain will need assurances as well. This next fuel must be produced, distributed, stored, possibly commingled with other fuels, pumped, and consumed without causing damage or requiring significant equipment modifications. Industry stakeholders understand that any new fuels must meet the needs of aircraft owners and be compatible with production, distribution, and dispensing systems.

EAGLE has worked diligently over the past 18 months to keep stakeholders informed, providing updates on the progress of key unleaded fuel developers. The General Aviation Modifications Inc.'s (GAMI) G100UL and Swift Fuels 100R are advancing through the STC process. GAMI has already secured a broad approved model list (AML) STC for its fuel in 2022 for piston



engines and airplanes. Recently, the FAA granted Swift Fuels its first STC for the use of its 100R in Cessna 172R and 172S model aircraft powered by Lycoming 10-360-L2A engines, with many additional engines and airframes being evaluated for approval in the weeks ahead. LyondellBasell/VP



Racing's UL100E is progressing through the PAFI pathway, having completed about 25% of critical materials compatibility and full-scale engine detonation and performance testing. Both Swift Fuels and LyondellBasell/VP Racing have also begun working through ASTM International on the development of an industry consensus production specification for their respective fuels.

The recent updates from EAGLE are optimistic. Progress is being made and general aviation's path to acceptance of unleaded fuel continues. To learn more visit flyEAGLE.org (see Stakeholder Meetings).

Congress and the FAA's commitment to this initiative is underscored by the 2024 FAA Reauthorization Act, which supports the continued availability of 100-octane low-lead (100LL) avgas until the end of 2030, or when a certified unleaded alternative is available at airports. (Alaska, a state heavily reliant on piston-engine aircraft, has been given a slightly extended timeline protecting continued availability of 100LL through the end of 2032). However, the collaborative industry/government EAGLE goal is clear: the elimination of leaded aviation fuel by the end of 2030.

General aviation is moving to ensure a safe, reliable transition to unleaded avgas without jeopardizing the operational safety of the piston-engine fleet. Aircraft owners must stay informed and engaged as this transition unfolds. It is important that they educate themselves on any restrictions that may accompany an STC and comply with any original equipment manufacturer (OEM) directives that may be issued. They are the key players in this process, and their comfort with these new fuels will drive this monumental shift.

It is not enough for the FAA to approve these new fuels. The industry from aircraft owners to fuel distributors to fixed-base operators (FBOs) that dispense fuel and aircraft manufacturers that provide continued operational support — must accept them. Safety, reliability, and commercial viability must guide this transition, ensuring that by the end of 2030, piston-engine aircraft can take to the skies with unleaded fuel that is dependable. The future of general aviation depends on it.

The Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative is a comprehensive public-private partnership consisting of the aviation and petroleum industries and U.S. government stakeholders, and a wide range of other constituents and interested parties, all working toward the transition to lead-free aviation fuels for piston-engine aircraft by the end of 2030 without compromising the safety or economic health of the general aviation industry. To learn more, visit flyEAGLE.org.

#### A GUIDE IN THE DARK

Much as we might enjoy flying at night, we're clearly not built for it. We're visual creatures and more specifically we're daytime visual creatures. That's not to say we can't operate at night, we're just at a disadvantage when compared to other creatures that are better equipped for the task. Because of this, there are some additional concepts and ideas we need to be familiar with before we venture off into the night. This magazine issue is a good place to start, but one of my favorite FAA resources, the Airplane Flying Handbook (AFH), is a wonderful place to make sure you're covering all your bases. Specifically, Chapter 11 covers the ins and outs of night operations from a variety of angles.

#### The Eyes Have It

The first area of focus, no pun intended, is the eyes. Aviation is a visually intense activity, and darkness plays an outsized role in night flying, so understanding how your eyes work is important. One example of how anatomy makes a difference in the night environment is in the composition and arrangement of the structures in the retina. The retina is essentially the "sensor" portion of the eye that receives the light coming in



from the world and translates that into a signal to the brain. The retina contains two different kinds of photosensitive cells that help you see in color during high light conditions (cones) and greyscale in darker conditions (rods). The cones are concentrated in the center of the eye while the rods are in the surrounding area. This leads to a shift from the center of your field of view towards the peripheral as light conditions decrease. And that's just one small piece of information about night vision that could be critical to your night flying. You'll find more in the AFH.

## Illusions, Airplanes, Lights, and More

The AFH also provides a quick refresher on things like the visual illusions you are likely to encounter at night. You can find a more detailed and entertaining explanation in our feature "Your Senses in The Shadows" in this issue. The same is true of the regulatory requirements for pilots and aircraft ("Vampire Rules" article in this issue) for a quick brush-up, but the AFH is a good reference for more detail.

An area we have less coverage on in this issue is airport and navaid lighting. Airport lighting is critical for night operations to replace the visual references that are missing at night. While airports may have different lighting arrangements depending on their size and scope of operations, knowing the differences can be helpful in identifying the correct airport and runway. You'll find that in the AFH too.

#### Step by Step

Last but not least, Chapter 11 of the AFH concludes with a step-bystep guide to night flying broken down by phase of flight. It discusses tips relevant to each phase, like a thorough review of weather information as part of preflight planning since the dark conditions will make it harder to avoid clouds if you're flying VFR. Another good tip regarding takeoff is to increase your scan of the altimeter and vertical speed indicator at night to compensate for the reduced visual references. During the day it's easy to see that you're climbing, but at night it can be less clear, especially if the departure path is over water or open ground without lit structures.

Whether you're a student pilot just starting out, a rusty pilot getting back into the game, or an experienced active pilot, the AFH offers an excellent base to work from. However, it's by no means an exhaustive resource on night operations. As the articles in this issue prove, there is certainly more to say than just what appears in this relatively brief chapter. However, while the chapter's brevity offers its own advantage for a quick refresher, be sure to seek out other resources. Whether they are other FAA handbooks, online courses, or trade press articles they can allow you to expand your nighttime knowledge.

James Williams is FAA Safety Briefing's associate editor and photo editor. He is also a pilot and ground instructor.

#### LEARN MORE

Airplane Flying Handbook, Chapter 11 bit.ly/FAA-AH

Pilot's Handbook of Aeronautical Knowledge, Chapter 17: Aeromedical Factors bit.ly/AeronauticalKnowledge

#### NOT ALL DRONE LIGHTS ARE THE SAME

One of the most important tenets of aviation safety is the requirement that all pilots be able to see and avoid obstacles and be seen by other pilots. When you are flying a drone, you are a pilot, so this applies to you. To ensure a safe flight, you must be able to see your drone at all times while also scanning the skies and ground around you for obstacles and hazards. As the sun sets and the skies darken, this task gets harder. Have you thought about how to accomplish this important task at night?

With the update to 14 CFR part 107 that became effective in March 2021, it's now easier to fly your drone at night — assuming you meet certain requirements. One of these requirements is that your drone be equipped with anticollision lights. While most drones are equipped with navigation lights, anticollision lights might not come standard straight off the shelf.

#### What's the Difference?

Navigation lights and anticollision lights have separate and important functions; both are needed for a safe flight at night. Navigation lights, also known as positional lights, are often red and green. For drone pilots, they are a visual aid to seeing your drone's orientation relative to you. If your drone has navigation lights, it's good practice to keep them on. Anticollision lights are flashing lights that are primarily designed to help other pilots see your aircraft and avoid collisions. They should flash, and be visible from all directions, to help manned pilots clearly distinguish your drone from other hazards, such as birds. These flashing lights should be white or red, and they are primarily intended to increase your



drone's conspicuity to other pilots. In the rare cases where pilots have been involved in a collision with a drone, they have consistently stated that they couldn't see the drone until it was too late to avoid it. Drones are hard to see, especially small ones. They blend in with the background and have slow maneuvering speeds. Anti-collision lights help make drones more visible.

#### A Closer Look

Unlike navigation lights that produce a steady light, anticollision lights have a blinking or strobe pattern. These bright lights can be placed on various parts of the drone so that it can be seen from multiple angles. To comply with part 107, these lights must be visible from a distance of at least three statute miles at night. Some part 107 waivers require daytime use of anti-collision lights that are visible for at least one statute mile. To reduce the risk of a collision, consider using an anti-collision light whenever you fly, regardless of the time of day. Without them, it is hard for manned pilots to distinguish drones from birds.

If your drone is not already equipped with anticollision lights, fear not. These lights have become fairly easy to install on most drones and are readily available as low-cost after-market add-ons. When purchasing a set, make sure you consider things like weight and power supply. Extra weight and power demands could quickly drain your battery and drastically reduce your flight time. With a little research, you should be able to find a set best suited to your flying needs.

Whether for fun, or for work, there are many reasons to fly your drone. Whatever reason you have for taking off, always remember that lighting is crucial to reduce risk and keep your flight safe. Knowing the different types of lighting and when to use them will help protect your drone and everyone around you.

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#### LEARN MORE

"Everything You Need to Know About Drone Anti-Collision Lights" pilotinstitute.com/drone-anticollision-lights

Small Unmanned Aircraft Systems (UAS) Regulations (14 CFR part 107) bit.ly/3YSQbaA

#### FIGHTING FATIGUE

Imagine this. You're out with friends watching the big game. You indulge in some adult beverages and tasty game day snacks — just a few won't derail your New Year's resolutions! It's getting late, but the score is close. You want to get home as soon as the game ends because you work tomorrow, but your partner wants to stay and celebrate the big win. This leads to an argument that puts a damper on the celebration, so eventually you head home.

The next morning, you sleep through your alarm. You don't have time for a shower or breakfast and grab a quick coffee as you rush out the door. Traffic is bad, and your temper gets the better of you when a driver won't let you over making you almost miss your exit. You make it to work just in time! Tired and a little stressed, you pick back up on the annual inspection you started the previous day almost on autopilot. At lunchtime, you grab some fast food and an energy drink and then get back to work. The previous night's festivities start to catch up with you as the day drags on. You have some more coffee and push through until quitting time. As you sit in more traffic on the way home, a bad feeling comes over

you. Did you use the right amount of torque on those cylinder head bolts? Did you check the correct direction of movement of the ailerons after you replaced the worn cable?

#### FATIGUE IMPACTS YOUR ABILITY TO PERFORM WORK IN VARIOUS WAYS.

The FAA lists fatigue as one of the "Dirty Dozen" — a list of twelve common causes of human factors errors that make up about 80% of maintenance mistakes. Fatigue, a physiological state of reduced mental or physical performance capability, can be caused by one or more lifestyle issues including stress, lack of sleep or exercise, poor diet, alcohol consumption, and even over-the-counter medicine, like ones used to treat allergies or coughs. Everyone experiences fatigue from time to time, but in the world of aircraft maintenance, it can have deadly consequences.

Fatigue impacts your ability to perform work in various ways. It can affect your ability to make good deci-

sions. Your attention to detail suffers. When you're fatigued you aren't as careful, and you might forget important steps or procedures. Some studies have shown that driving fatigued can be as dangerous as driving drunk. The same can be said about performing maintenance when fatigued. So, what can you do to fight fatigue and all the dangers that come with it?

Winning the fight against fatigue starts with sleep. Most people fall short of the eight hours per night we all need to wake up well rested. In addition to this basic requirement, your sleep hygiene is also important. Stop your caffeine intake at least six hours before bedtime. Limit screen time at night, and refrain from it altogether in the hour leading up to sleep. Try not to work out in the hours before bedtime either. Make your bedroom as relaxing and comfortable as you can.

In addition to improving your sleep habits, there are other lifestyle factors that will help you combat fatigue. Get plenty of regular exercise — at the right time of day. Try to eat a healthy balanced diet and limit alcohol. Be aware of the side effects of all medications you take, including over-thecounter medications. Find healthy ways to deal with stress like talking to a friend, taking a walk, or even trying out meditation.

Fatigue can sneak up on you and impact your ability to work safely, so take good care of yourself. The aircraft you maintain and the people who fly in them are counting on you to keep them safe!

#### Rebekah Waters is an *FAA Safety Briefing* associate editor. She is a technical writer-editor in the FAA's Flight Standards Service.

#### LEARN MORE

FAA MX Fatigue Focus Newsletter bit.ly/3AXNufX (PDF download)

Fatigue Countermeasures, FAA Safety Briefing, Mar/Apr 2023 bit.ly/4eJkRkk



#### TAKING THE FRIGHT OUT OF ROTORCRAFT NIGHT FLIGHT

For helicopter pilots, night flying can present a unique set of challenges with additional risks and threats to safety that must be mitigated. Threats such as reduced visibility, altered depth perception, and diminished spatial awareness all contribute to the complexity of operating at night. To ensure safety, helicopter pilots rely on various techniques such as utilizing celestial illumination, preplanning for off-airport landings, and taking precautions to avoid hazards.

Celestial illumination, the natural light provided by the moon and stars, plays a key role in enhancing visibility during night flights. On a clear, moonlit night, natural light can significantly aid a pilot's ability to see terrain features, identify obstacles, and evaluate potential landing zones. The phase of the moon, cloud cover, and weather conditions all directly affect the amount of light available. During a full moon, there is more ambient light to support night vision, but during a



new moon or overcast nights, pilots may encounter darker conditions that require additional caution.

For pilots flying without night vision goggles (NVGs), celestial illumination becomes even more critical. Monitoring lunar phases and weather forecasts before a night flight allows pilots to better anticipate the available light and plan accordingly. Flying in remote areas with little or no artificial light requires pilots to use the stars and moon to their advantage, helping them to maintain better spatial orientation in an otherwise dark environment.

Nighttime off-airport landings are particularly risky due to reduced visibility and limited ability to assess terrain. Pilots attempting off-airport landings at night should take extra precautions, such as performing an assessment of potential landing zones during the day, if possible. While daylight operations allow for a thorough visual inspection of a landing zone, nighttime operations depend more on preflight planning and careful approach techniques. The Helicopter Flying Handbook notes that pilots have a tendency to focus too much on the landing area and don't pay enough attention to airspeed. If too much airspeed is lost, a vortex ring state condition may result. Unlike during daytime operations, it is difficult to judge the helicopter's rate of closure using outside references at night. Pilots need to pay special attention to the airspeed indicator and maintain some form of forward airspeed until close to the ground.

Additional considerations for night flying include familiarization with obstructions along the route. The *Helicopter Flying Handbook* highlights that poor reflective surfaces, such as wires and small tree limbs, are difficult to detect. Pilots should always review the most current hazard maps with known wire locations before night flights.

Migrating birds pose an additional threat during night flights, especially during peak migration seasons in the spring and fall. Keep in mind that many bird species migrate at night to take advantage of cooler temperatures and to avoid daytime predators. Ninety percent of reported bird strikes occur at or below 3,000 feet above ground level. To mitigate this risk, pilots should review migration forecasts and adjust flight altitudes or routes when necessary. Understanding migration patterns and avoiding high-risk areas during peak times can significantly reduce the chance of encountering migrating birds, which can cause severe collision damage.

With mindful preparation and attention to night-specific challenges, helicopter pilots can navigate the complexities of night flying with greater safety and confidence. For more in-depth guidance on night operations, pilots can refer to the *Helicopter Flying Handbook*, which provides comprehensive information on night vision techniques, landings, and managing unique nighttime hazards.

Leah Murphy is a dual-rated flight instructor and helicopter air ambulance pilot. She is also an FAA Safety Team Representative in Cleveland, Ohio.

LEARN MORE

Helicopter Flying Handbook, Chapter 12 bit.ly/FAAHelicopterHandbook



www.Facebook.com/groups/GASafety



#### Check out our GA Safety Facebook page at Facebook.com/groups/ GASafety.

If you're not a member, we encourage you to join the group of nearly 17,000 participants in the GA community who share safety principles and best practices, participate in positive and safe engagement with the FAA Safety Team (FAASTeam), and post relevant GA content that makes the National Airspace System safer.

#### Don't Wait to Watch This Video

If you haven't already watched the "Line Up and Wait" video from the *From the Flight Deck* series mentioned in the ATIS section of this issue, wait no longer! Some who have already watched have expressed their gratitude for the clarification of the instruction and shared their own experiences. Check out the video and leave your own feedback at bit.ly/4fdbSck.

Very nice video. I'm an Airport Operations Officer at Anchorage International Airport. Our ATC uses "line up and wait" a lot so everyone is used to hearing it, especially on RWY 33 due to RWY 07L being in the jet blast zone. It is also very common to hear a pilot ask ATC "confirm cleared for takeoff?" If they were given "line up and wait" the controller will say, "negative, line up and wait." If unsure *ALWAYS ask.* 

— @bobrieth4081

Great video; thanks for creating it. Please do more like this. It's nice to have these reminders, even though every pilot will tell you that this can never happen to them! I like that you went into the "why" this happens — smart people make mistakes, and sometimes, if we understand why this can happen to even good and experienced pilots, it can stick better in our memories.

— @dermick

"Line up and wait" is internationally recognized as the way to get an airplane lined up and ready for departure. The word (takeoff) can and must only be initiated by the tower controller. Quite often, I hear pilots responding to "line up and wait" with "cleared to line up. " This is not a clearance; this is an instruction! Happy flying to all. — @Global8001

#### Habitat for Aviation's All-Women Airplane Build

This episode of the FAA's podcast, The Air Up There, discusses Habitat for Aviation, a nonprofit that's preparing the next generation of airplane mechanics, pilots, and avionics specialists. Habitat for Aviation aims to ignite a spirit of courage and innovation in women aspiring to enter the



aviation field, much like Rosie the Riveter inspired countless women to take on roles in industries traditionally dominated by men during World War II. And Instagram (bit.ly/4i17lM8) was feeling the girl power! Listen to this and other episodes at faa.gov/podcasts/ the\_air\_up\_there.

I look forward to the build and volunteering every Sunday with these ladies — @rayanelkotob

Love seeing women in aviation!

- @ticaerospace

Not to mention an awesome place where adults get to learn as much as the youth.

— @lil\_emma\_d1



For more stories and news, check out our blog "Cleared for Takeoff" at medium.com/FAA.

Let us hear from you! Send your comments, suggestions, and questions to SafetyBriefing@faa.gov. You can also reach us on X (formerly Twitter) @FAASafetyBrief.

We may edit letters for style and/or length. Due to our publishing schedule, responses may not appear for several issues. While we do not print anonymous letters, we will withhold names or send personal replies upon request. If you have a concern with an immediate FAA operational issue, contact your local Flight Standards Office or air traffic facility.

#### COMING THROUGH WITH "FLYING COLORS"

Humans have always had a complex and often personal connection to colors. After all, they are so much more than random reflected wavelengths of visible light. Colors have deep cultural and symbolic meanings, not to mention the ability to influence our emotions, moods, and even our buying habits. I'm a sucker for anything blue myself.

Colors can also be used to warn us about something dangerous or lead us to safety. This is no more evident than with the use of red and green. The safety implications of these two colors have particular importance in the transportation industry, from the vibrant reds used in brake lights, stop signs, and firetrucks, to the cool greens that indicate the locations of an emergency exit or safety equipment.

There's some science, as well as some interesting history, behind the use of red and green lights as critical safety indicators. Since red has the longest wavelength, it can be seen from a longer distance than other colors making it a natural choice as a color to warn folks. As for green, it has the highest luminous efficiency, which means it appears brighter and more visible than other colors.

On the history front, the color combo has its roots in maritime use



where ships would hang red lanterns on the port or left side of the ship, and green on the starboard, or right. It's thought that red was chosen for the left since ports were indicated with red lights and many ships would dock on the port side. In 1846, the United Kingdom passed an Act that required red and green side lights for all sea-going steam vessels, followed by a similar Act in U.S. Congress in 1849. Incidentally, maritime history is also tied to the colorful idiom I chose for the title. Ships that were successful in battle would often return to port with their colors (flags) raised high to indicate success at sea.

As pilots, we're of course even more attuned to the importance of red and green. They are ingrained in many of our actions during flight and play an integral role in keeping us out of danger, especially at night. We rely on reds and greens to inform us about proper (or excessive) airspeeds and RPMs, help us avoid obstructions on the ground, identify an airport at night, keep us on the right glide slope, and allow us to determine the relative position of our fellow flyers, just to name a few. One less common example, but undoubtedly critical when needed, is the ATC

light gun signals used when your radio has given up the ghost.

I can attest to that criticality having had an unfortunate "been there, done that" moment early in my flight training. It's something you train for, but never expect to use. In my case, the process worked just as it should have. After going NORDO (no-radio) at night a few miles outside the pattern of a busy towered airport, I nervously squawked 7600, not really sure of what to expect next. Within seconds, I felt a rush of relief as I literally got the "green light" to land. I never got to do a real-world light gun signal exercise in my training, but I highly recommend it. I also suggest you periodically brush up on your light gun signals. Do you remember what an alternating red and green signal indicates? You can view a light gun signal card on the FAA's runway safety site at bit.ly/4eGMz1h.

When flying at night, understanding what another aircraft's red, green, and white navigation (position) lights are indicating can also be a lifesaver. If you see both a red and green light of another aircraft, and the red light is on the right and the green to the left, you could be on a collision course. Right of way rules dictate that the aircraft (of the same category) to the other's right has right of way. If you only saw another aircraft's green navigation light, the other aircraft would be to your left and you would have right of way. If you see just red, give way. Seeing only an aircraft's white navigation light on the other hand would indicate that an aircraft is moving away from you.

With shorter days and longer nights, winter flying focuses more on low — or no-light environments. Know your surroundings, do your planning homework, and heed the meaning and importance of those aviation night lights!

Tom Hoffmann is the editor of FAA Safety Briefing. He is a commercial pilot and holds an A&P certificate.

#### **CHRIS CRISWELL** Manager, FAA Airport Data and Airspace Branch

For Chris Criswell, an interest in aviation hit him like a random dart hitting a map. While flipping through a course catalog at the University of Maryland Eastern Shore, looking for an interesting elective, his finger stopped on a private pilot course.

"After attending the first class, I was hooked," he explains. "I quickly scheduled an intro flight at Salisbury Airport, where I took to the skies for the first time in a 1978 Cessna 152. I was all in from that point."

Chris continued flight lessons after the class and worked as an airport lineman to help pay for his private pilot certificate. He soloed in 2001, shortly after graduating from Salisbury University. However, his degree wasn't in aviation; it was in geography. Chris earned his wings while working as a geographic information system (GIS) analyst at Naval Air Station Patuxent River, Md.

Joining the FAA in 2002 was another spin of the globe. Chris was preparing for his instrument rating and went to faa.gov to download the new certificate/rating application form when he saw a link on the website for jobs at the agency.

"I quickly scrolled through the FAA jobs list and found a cartographer position," he notes. "My pilot certificate and a geography degree fit the job perfectly, so I applied."

At the FAA, Chris focuses on developing better processes and systems for collecting and disseminating aeronautical data and information. He has worked within the Air Traffic Organization's Aeronautical Information Services directorate, the UAS Integration Office, and now as the branch manager of the Airport Data and Airspace Branch in the Office of Airports Safety and Standards. The branch develops and maintains data standards, policies, and procedures for collecting and analyzing airport and airspace data for more than 19,000 landing areas within the National Airspace System (NAS). The data is collected and analyzed within the Airport Data and Information Portal (ADIP) at adip.faa.gov. It consists of a robust set of applications used to analyze, verify, and validate airport and airspace data to ensure data integrity before being provided to various users.

"One of our primary users is Air Traffic's Aeronautical Information Services to support the aeronautical information products they produce for pilots," Chris details.

ADIP also recently received its first ISO 9001 certification, which meets the International Civil Aviation Organization (ICAO) requirement of establishing a quality management system (QMS) to manage aeronautical information. This is a step forward in meeting the FAA's vision "to reach the next level of safety and efficiency and to demonstrate global leadership in how we safely integrate new users and technologies into our aviation system."

An ADIP search tool is also available to the public. It has everything from facility details to a kneeboard doc, charts, and an airport master record — all good references to aid in a nighttime preflight plan, the theme of this issue. In Chris's experience flying GA aircraft at night, his biggest challenge is dealing with poor taxiway lighting and markings, which makes the airport diagram — available on ADIP — an essential nighttime tool.

Another challenge at airports is the wildlife. At night, they are much harder to see and avoid. And if you do encounter one, an emergency landing



is more difficult in the dark. Chris can attest to that.

In the early evening hours of Oct. 31, 2021, Chris struck a cormorant (a sizeable aquatic bird) on takeoff. The bird went through his windscreen. He describes the event in this FAA Wildlife Video at bit.ly/FAAbird. Preparation is essential for any flight, but even more so when visibility is limited; obtain as much information as possible for your flight before entering the airplane.

"Review the airport diagram, sketch, or satellite imagery of the airport before getting into the plane so that you can anticipate where you may be taxing," he adds. "Pick up VFR flight following if available, file a VFR flight plan, carry a red flashlight with extra batteries, and be organized to reduce distractions."

That's a lot of aeronautical data and information needed to prepare adequately for a night flight. Looking to the future, Chris sees technology like artificial intelligence as a tool to help analyze the various data sources for weather, air traffic, performance, aeronautical data, and NOTAMs to help create the most efficient and safest flight for increased situational awareness. Until then, fly safe and prep hard.

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U.S. Department of Transportation

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