NIGHT FLYING

Spectacular, safe with proper knowledge, training, and judgment

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You sit in the darkness at the end of the runway and carefully check the instruments and gauges in the soft glow of the cockpit lights. Ahead, two rows of runway lights lead into the star-studded sky. Pondering your departure, you wonder what's really waiting for you in the darkness.

Virtually every aspect of flying at night is different from the clear light of day. The aircraft is more difficult to inspect. The cockpit takes on an air of unfamiliarity as it fades in the dim red glow of the panel lights. Weather becomes more important, as does flight planning and attention to cockpit organization.

Engines that run smoothly by day mysteriously run rough in the dark, and nightmarish thoughts of forced landings emerge from the dark recesses of your mind. Still, the magic of cruising beneath starry skies and above the brilliant glitter of city lights more than overcomes the anxiety of flying at night.

Pilots in many countries must have an instrument rating to fly at night. Many pilots believe this is a good idea because flying at night can be as close to instrument flying as you can get in visual conditions. And the potential for unwittingly flying from visual to instrument meteorological conditions (IMC) is at its greatest.

Your best defense, the best strategy, is to combine skill and judgment with an in-depth knowledge of night flying. Each step in the process of a night flight requires special knowledge and close attention to detail.

Flight planning

Planning a night cross-country flight requires special attention to many details that may escape your scrutiny when planning a daylight flight. The landmarks that will guide you to your destination look different at night. Many familiar features will be hidden beneath the veil of darkness, and new landscapes take their place.

Lakes, rivers, railroads, and fields fade into blackness, while cities appear as crystalline mazes of lights. Lighted towers, difficult to see by day, suddenly come to life against the night sky. While many roads may be invisible, streetlights and traffic may illuminate interstates and other highways. Airports that were difficult to find during the day may mark their location with bright, flashing green-and-white beacons.

Though you navigate by pilotage during the day, you may want to rethink your strategy at night. Because the terrain can look unfamiliar and desolate at night, it's easy to find yourself off course (or, at least, beginning to question your true position). To avoid this, back up your pilotage with radio navigation. Select the VORs or NDBs (nondirectional beacons) that will guide you to your destination.

Terrain clearance is another nighttime concern; like low clouds, darkness can easily obscure high terrain. To ensure adequate clearance along your route, note the Maximum Elevation Figures (MEFs) printed in each quadrant of your sectional chart. Then add at least 1,000-2,000 feet to the highest MEF figure and use the sum as your minimum en route flight altitude.

Since it's difficult to read the fine print on a sectional in a darkened cockpit, record the appropriate communication and navigation frequencies, along with any other pertinent flight information, on your navigation log. Don't use a fine-point pencil because it may be difficult to read. Opt instead for dark ink and large print. Don't use a highlighter on your chart. Depending on the color, in the cockpit's red light it may appear as a solid black line through which nothing can be read.

Finally, study your route carefully and be familiar with landmarks, navigation aids, and your destination airport. Commit as much information as possible to memory, and make sure it's all down on your navigation log.

Even though Federal Aviation Regulation (FAR) 91.151 only requires a 45-minute fuel reserve for night flights under visual flight rules (VFR), headwinds, navigation errors, and unexpected weather can deplete reserve fuel at a frightening pace. Prudent pilots pad their fuel reserve with at least twice the minimum required.

Night weather

The only real difference between day weather and night weather is that you cannot see night weather. For this reason, it's extremely easy to unintentionally fly into weather you wouldn't get near during the day. To avoid this problem, always get a thorough and detailed weather briefing.

As you digest the briefing, remember the variability you've seen in daytime weather. Clouds that were forecast for 5,000 feet magically appear at 2,000 feet. Unless you're instrument rated, equipped, and current, you might consider canceling a long night cross-country flight

unless the forecast calls for clear weather, and you can look outside and see the stars. Even then, you might get a surprise.

The weather briefing a friend and I received for a night flight from Denver to Santa Fe, N.M., promised clear skies and light winds for the entire route. In spite of the outstanding prognosis, our route crossed some high mountains, so we filed under instrument flight rules (IFR).

In hindsight, filing IFR was a wise decision. Ten minutes after takeoff, we were flying through blinding snow showers. Fortunately, it was so cold that ice didn't form, and we shortly emerged into clear conditions again. But if we hadn't been prepared for the unexpected, the flight would have been much more stressful than it was.

Preflight

The first rule for a night preflight inspection is to do it during the day whenever possible. Many problems are more difficult to spot at night, and a flashlight does not replace the sun. This does not mean you can bypass a final check before departure, but a daylight preflight will give you added peace of mind.

One item essential to your night preflight is to check all aircraft lights—taxi and landing lights, rotating beacon and anti-collision lights, position lights, cockpit lights, and flashlights. They should all work. Since electrical power is of the essence, be sure to check the alternator belt for obvious defects and proper tension.

Checking for fuel contamination is especially difficult at night. One technique is to hold the fuel sampler against a white background and shine a light from the side to verify proper grade and purity.

While preflighting the aircraft is crucial, don't forget the importance of preflighting yourself. Night flying can be demanding, especially when things start to go awry. So be conservative and remember that some unique medical factors come into play at night. The most important concerns your vision. Your eye (retina) has two types of receptors. Cones provide clear, focused vision in well-lighted conditions. Rods, while they don't see as clearly, adapt more readily to low-light conditions.

It can takes 30 minutes or more for your eyes to adapt to low light, but 20 minutes in dim red cockpit lighting will provide a moderate degree of adaptation. Once your eyes have adapted, if you look at white lights, the adaptation process must start again. At brightly lighted airports, you cannot avoid this exposure, so remember that your night vision may be impaired for some time after takeoff.

Altitude also degrades your night vision because the eyes' demand for oxygen increases as

the light dims. And if you smoke or have inhaled carbon monoxide, your vision will be even thinner. For this reason, some experts recommend the use of oxygen for night flights above 5,000 feet.

Another night flight medical consideration concerns your biological clock, or circadian rhythm. Regardless of other factors, circadian rhythms tell us to sleep when the sun goes down. They slow your mental functions, which means you tend to be more complacent—not something to be during a night flight. Flying with a passenger or another pilot, or frequent contact with air traffic control (ATC), Flight Service, or Flight Watch can help keep your brain engaged during the flight.

Cockpit organization

Cockpit organization is important for daytime flights; it is doubly important at night. Have a flashlight or two with fresh (and spare) batteries within immediate reach. You never know when the lights may go out. Charts should be carefully organized and stowed within easy reach. Above all, be familiar with the cockpit layout, including the location of all controls, instruments, and cockpit lighting. Finally, before starting the engine, turn on the anti-collision beacon to warn others that you're about to start the engine.

Ground operations

Ground operations are more difficult at night, especially at an unfamiliar airport. Study the airport diagram to avoid confusion and become familiar with the taxiway layout and designations. Then ask ground control for progressive taxi instructions. The controller will lead you step by step from where you are to where you want to go. The object of this is to keep you from going where you don't want to (or are not supposed to) be, like on an active runway.

Although a landing or taxi light makes it easier to find your way around the airport, there are times when these lights should be turned off. When waiting at the hold line at an active runway, turn off your landing and taxi lights so they won't blind or distract a landing pilot. You should also turn them off when on a taxiway that parallels the active runway. As a courtesy to other pilots, don't turn on your strobes until you're on the runway. Flashing strobes can temporarily blind a pilot or cause vertigo in a pilot on approach.

Departures

Night departures, regardless of conditions, should be considered instrument flight—even by VFR pilots. There are just too many illusions and problems that can arise to foul up your visual senses. The false horizon illusion is but one example.

A string of lights across the canvas of night can appear as a horizon. Rolling your wings level to such an illusion can place the aircraft in a steep bank. At low altitude and with little

time to sort out the true picture, this can be a real killer.

Another problem can come from sparse lighting on the ground, which can create the illusion of a star-studded sky. Again, a pilot relying solely on visual references may place the aircraft in an unusual attitude trying to sort out the picture.

With these points in mind, plan and fly your departure like an instrument departure. As you approach the end of the runway in the initial climb, transition your scan from the outside environment to the instruments and keep the aircraft climbing straight on course until you've reached a safe altitude of a thousand feet or more. But before you attempt this, spend some time flying at night with your flight instructor.

En route operations

Some aspects of flying, such as finding an airport, can be easier at night than during the day. But many tasks are much more difficult. Reading sectional charts is a good example. This often requires a white light, particularly if you need to discern the colors on the chart. If you must turn on the cockpit lights, try closing one eye to retain dark adaptation.

Thanks to aircraft lighting systems, see-and-avoid collision avoidance is often easier at night. But there are illusions that can play havoc with your see-and-avoid scan. Autokinesis is one such illusion. If you stare at a stationary light against a dark background, it will appear to move in time. If, for example, you stare at a bright star, your mind may think it's moving, and thereby take it to be another airplane. To avoid autokinesis, don't stare at lights.

Staying busy is the best way to fight the complacency commanded by your circadian rhythms. Start by requesting flight following after you take off. Not only does this give you someone to talk to (but you shouldn't chat for conversation's sake), it gives you another set of eyes looking for traffic and a ready source of help if things go awry.

Another essential and productive task is to get updated weather information from Flight Watch, a Flight Service Station, and recorded sources such as AWOS (Automated Weather Observing System), ASOS (Automated Surface Observing System), and HIWAS (Hazardous In-Flight Weather Advisory Service).

The frequencies for these services are listed in the Airport/Facility Directory (A/FD), and you should write them on your navigation log. Don't forget to keep your own eyes open for changing weather conditions. Changes in the weather can be difficult to detect at night, and they can sneak up and take you by surprise.

If you start to lose sight of the stars, you may be flying under or into the clouds. If ground lights begin to look hazy, you may be flying into a layer of clouds or fog. Even though the visibility appears fine, you may be flying through precipitation. Sparkles illuminated by your

strobes indicate precipitation such as rain or snow showers. Remember that landing lights and strobes can cause vertigo when flying in clouds and precipitation, so don't hesitate to turn them off.

All of these phenomena are good indications that you should find the nearest airport and land. If you are not instrument rated, not only are you getting in over your VFR head, but precipitation at night often signals the development of more serious weather, such as rain-induced fog. If it is cold, precipitation may cause airframe icing.

Arrivals

While some motels will keep a light on for you at night, if you are flying to an airport without a tower, or arrive after the tower closes, chances are you will have to order the lights to brilliance. Airports with pilot-controlled lighting are identified in the A/FD and commercial references. Determining what kind of lighting system your destination has, and how you activate it, is a critical part of your preflight planning.

Most pilot-controlled lighting is activated by clicking the microphone button a certain number of times—3, 5, or 7 times for low, medium, and high intensities—when the radio is tuned to the Common Traffic Advisory Frequency (CTAF). But this procedure is not universal. Some airports use different frequencies and different activation procedures. The A/FD will provide the specifics.

Pilot-controlled lights can usually be activated when you're within 5-10 miles of the airport. Activating them at this distance can help you find the airport. But remember that the lights usually turn themselves off 15 minutes after they were first activated. To keep the lights from going out when you're on final approach, key your mike the required number of times when you are on the downwind leg (even if you are practicing touch-and-goes).

Determining wind direction at night is not too difficult. Many airports have illuminated windsocks, so you can overfly the airport and determine the wind direction and on which runway to land. Even if ATIS (automatic terminal information service) is not in service, many airports now have an ASOS or AWOS that provides weather information 24 hours a day.

Even armed with proper lighting and weather information, night arrivals call for special considerations. The approach and landing picture is often devoid of the normal visual cues, and many visual illusions can result in seemingly dumb mistakes. Lights along a street can easily create the appearance of a runway, for example. Even airline pilots have been known to make approaches to lighted streets and parking lots.

The black hole approach is one of which to be wary. It occurs when few lights or terrain features are visible around the airport—the runway and lighting system seems to float on a sea of blackness. This situation can create the illusion that you're higher than you really are. In trying to get down from what seems to be too high an altitude, a pilot can land short of

the runway.

For VFR pilots, the best way to avoid night illusions is to fly to and from airports equipped with VASI or PAPI approach lighting systems. They provide guidance on the correct approach path and obstacle clearance within 4 nautical miles of the runway. If you are instrument rated, flying an instrument approach, even in good VFR weather, will keep the illusions in check.

If you are not instrument rated, and the airport doesn't have approach lighting systems, there are ways to plan a safe descent. If your aircraft has DME (distance measuring equipment) and there is a VOR or localizer on the airport, your DME distance from the field can be used to gauge your descent. A standard 3-degree glidepath descends at 300 feet per nautical mile. On a 5-mile final, you should be 1,500 feet above ground level (AGL); at 3 miles, about 900 AGL; and on a 1-mile final, 300 AGL.

Another tactic for avoiding faulty approaches at night is to fly over the airport and enter a standard landing pattern. I prefer to fly a slightly higher pattern and a steeper-than-normal approach. This keeps me within gliding distance of the runway should the engine have a surprise in store for me. The higher approach angle also helps to avoid unseen obstacles on the approach. This is especially important if the runway isn't equipped with a VASI, PAPI, or other glideslope indication. If the runway lights seem to blink or flash on your approach, beware—this usually means that obstacles on the glide path are between you and the lights.

Knowing when to flare for a night landing can be challenging, but there are a few tricks that can help. One is to begin the flare when the touchdown zone and tire marks appear clearly in the beam of the landing light. Be careful not to fix your gaze there. Look ahead at the runway lights and finish the flare as you appear to sink below their level. This technique works well even with an inoperative landing light. Finally, since animals (large and small) often find their way onto rural runways at night, watch for the reflection of their eyes during takeoff and landing, and be prepared to abort if necessary.

Pilot proficiency and night emergencies

If you are a certificated pilot flying solo, the currency requirements for flying day or night are the same. But if you will be carrying passengers at night, FAR 61.57, Recent Flight Experience: Pilot in Command, requires that you make a minimum of three takeoffs and landings, each to a full stop, within the preceding 90 days in category and class of aircraft to be flown.

As with many of the regulations, this is a minimum requirement. Meeting the letter of this regulation in no way guarantees any degree of proficiency. A more rigorous approach to proficiency raises the level of safety.

Engine failure is probably the most-feared night emergency because one never knows what obstacles lie on the darkened terrain below. But engine failures are no more likely at night than during the day; their primary cause is still fuel mismanagement. To reduce the potential for fuel exhaustion, be ultra-conservative in fuel management. Plan your flight over areas that offer more airports and the best available off-airport landing sites, and fly higher to increase gliding range. Include the engine instruments as part of your scan to more readily detect developing problems.

While engine failure is the most-feared night emergency, inadvertently flying from VFR into IFR weather is a far more common—and deadly—occurrence. Prevention is the best cure, but it's best to be prepared for the worst. If you're a VFR-only pilot, practice basic hood work and unusual attitude recovery often with a qualified instructor. If you've never practiced your instrument work at night, you'll be behind the eight ball if a problem arises. So combine your hood work with some night flying. Better yet, get started on that instrument rating or complete your next instrument currency check at night.

Electrical failure at night is more problematic than in daylight. A partial failure could be the loss of cockpit lights, or a loss of navigation or communication capabilities. A burned-out landing light is more of an inconvenience than an emergency, however. The best strategy for coping with an electrical problem is to be prepared. Carry several flashlights and a handheld transceiver (with fresh and spare batteries). Think about and practice emergency procedures with an instructor at night. And pay close attention to your ammeter or load meter. As soon as you see a discharge or reduction in load, find someplace to land before a complete electrical system failure occurs.

Night flying can truly be spectacular and safe with the proper knowledge, training, and judgment. Many times I've found myself sitting at the end of the runway at night and wondering what may lie ahead. Although some night flights kept me on the edge of my seat, others have become some of my most cherished moments in flight.

Night flight regulations

There are a number of regulations that specifically address night flight. For more details, consult the Federal Aviation Regulations.

Pilot requirements:

FAR 61.57—You cannot act as pilot in command (PIC) while carrying passengers from 1 hour after sunset to 1 hour before sunrise unless you have made three takeoffs and landings to a full stop in the same category and class of aircraft within the preceding 90 days. This is a minimum requirement; additional training or practice may be required to achieve a reasonable level of proficiency.

Aircraft equipment:

FAR 91.205—In addition to the day requirements, your airplane needs position lights; anti-collision/strobe lights; a landing light if operated for hire; an adequate source of electrical energy to operate the required equipment; and spare fuses (one spare set, or three of each kind.)

Flight operations:

FAR 91.151—You must carry enough gas to reach your first point of intended landing, and then an additional 45 minutes at normal cruising speed. Remember that this is a minimum fuel reserve, not a target for flight planning. Prudent pilots always carry more than the minimum to better accommodate potential problems.

FAR 91.155—VFR visibility requirements in Class G airspace increase from 1 mile in daytime to 3 miles at night. The only exception is for operations within a half-mile of a runway, in which case VFR pilots can operate with 1 mile visibility while staying clear of clouds. But remember, just because it's legal doesn't make it safe. Prudent pilots typically set higher weather minimums for night VFR flights.

FAR 91.157—In order to get a Special VFR clearance at night, you must have an instrument rating, an instrument-equipped airplane, 1 mile visibility, be able to remain clear of clouds, and a Special VFR clearance from air traffic control.

FAR 91.209—You must use position and anti-collision lights between sunset and sunrise, but this regulation says you can turn off the anti-collision lights for safety, such as when flying in precipitation.