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[I] = Illusions

Nighttime Perils of Perception

I love driving in the snow! Now I may be biased since I grew up in Wisconsin, but driving on back country roads at night with snowflakes falling all around can be a lot of fun. It feels like you're flying through space — and who doesn't like flying? Turn the high-beams on, and all you see are white flashes of fluff in every direction.

If you are thinking in the back of your mind that this scenario could turn into a potential disaster, you are correct. That being said, now consider that you are flying VFR at night in the exact same conditions. The visual reference to the moving snow makes it feel like you are going at "warp speed," and the opportunity for avection illusion to occur becomes high. Avection illusion, also known as a "false motion" illusion, is one of self-motion. It is similar to what might happen if you are on a train and a nearby train moves, giving you the sensation that you are moving in the opposite direction when in truth you are still stationary.

After snapping out of your trance, a quick check of your instruments reveals what you need to know.

Your airspeed is in the green. Good, not going at warp speed. Your vertical speed indicator shows level. Good. Your attitude indicator shows blue on the bottom. Not good. Emphatically NOT GOOD!

Spatial Disorientation

A pilot can experience many kinds of illusions in flight. That's because we are genetically designed to maintain spatial orientation on the ground. The flight environment creates sensory conflicts that make it difficult to determine spatial orientation. Statistics show that approximately 10 percent of all general aviation accidents can be attributed to spatial disorientation and, sadly, the vast majority of these accidents are fatal.

You can prevent illusions of motion and position by maintaining a reliable visual reference to fixed points on the ground or, when the ground is not visible, to flight instruments. At night, your outside visual references on the ground may cause illusions when you see those references from different altitudes. For example, at 2,000 feet, you might see a



Photo by Maj. Robert Bowden, Civil Air Patrol

group of lights on an object individually. At 5,000 feet or higher, the same lights could appear to be a single, solid light mass.

If you start to see a halo or glow around the lights on the ground, then you may be flying into a layer of clouds or fog. Remember that if you have to descend through fog, smoke, or haze in order to land, the horizontal visibility when looking through the “soup” is considerably less than it is when looking straight down through it from above. As the *Airplane Flying Handbook* states (and aviation safety advocates agree), under no circumstances should you make a VFR night flight during poor or marginal weather conditions unless both the pilot and aircraft are certificated and equipped for flight under instrument flight rules (IFR). It follows that if you and the airplane are legal for IFR, it’s a much safer bet to file and fly that way than attempt night VFR in less than good weather conditions.

Crossing large bodies of water at night in a single-engine airplane is also potentially hazard-

ous because the horizon blends with the water and makes it difficult to establish depth perception and orientation. Even on clear nights, the stars reflect on the surface of the water, making water and sky blend together into one continuous array of lights.

Black Hole Effect Awareness

If you have ever watched a sci-fi show, you know flying near a black hole never ends well. The same is true for black hole effect, which is one of the most dangerous illusions to GA pilots.

Here on Earth, black hole effect occurs when you land from over water or non-lighted terrain and runway lights are the only source of light. Without peripheral visual cues to help, it is challenging to maintain orientation. Any downsloping or upsloping terrain will make the runway seem out of position. Bright runway and approach lighting systems with few lights illuminating the surrounding terrain may create the illusion of less distance to the runway. If you believe this illusion, you may lower the slope of your approach and impact terrain before reaching the runway.

Pilots might be surprised to know that a black-hole illusion can be black, gray, or white, and it doesn’t always happen in the dark of night. Having another crewmember in the cockpit can help if you get disoriented. If you believe that has happened to you and you are fortunate enough to have a fellow pilot along, don’t hesitate to turn the flight controls over to your companion until you regain your bearings. Also, don’t be afraid to chat with ATC about what you are up against. If you are not confident in your landing, execute a go-around.

A similar illusion can happen over water or unlighted terrain on a night with no stars or moonlight. The sudden loss of a horizon or any ground reference can quickly produce vertigo. A pilot suffering from vertigo might bank

the airplane and push the yoke forward, which can produce a graveyard spiral. Alternatively, the pilot might bank the airplane and pull back on the yoke, which can lead to a stall/spin. Neither of these scenarios ends well at low altitude and low airspeed.

For VFR pilots, a good way to avoid night illusions is to fly to and from airports with a visual approach slope indicator (VASI) or an approach lighting system. These aids provide guidance on the correct approach

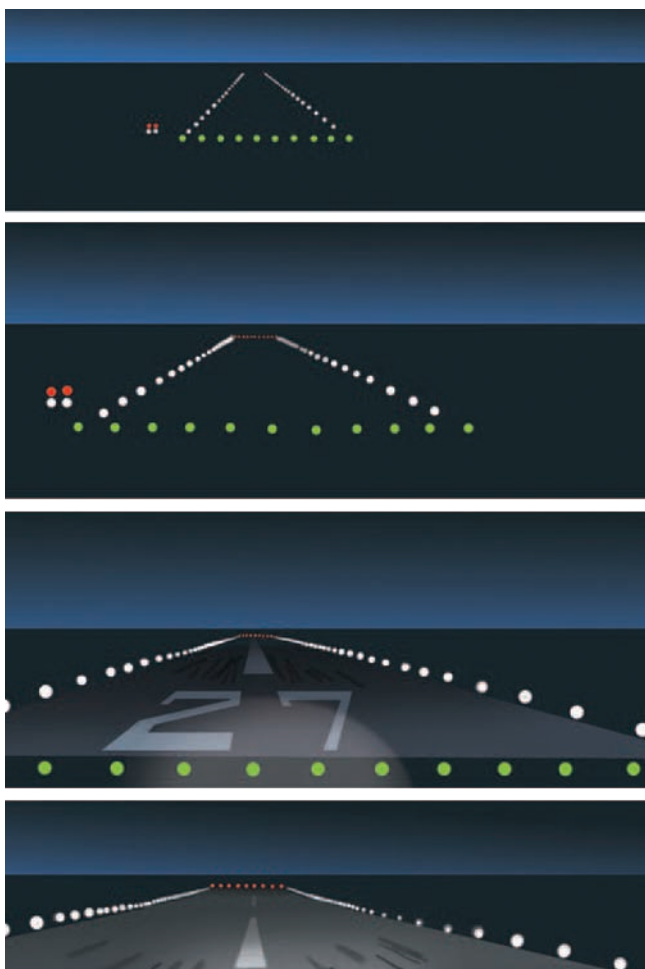
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path and obstacle clearance within four nautical miles of the runway. (Read *Nightlights* for more about airport lighting.) IFR pilots can use electronic glide slopes to assist in flying the correct glide path even in visual meteorological conditions (VMC).

Preventing Perils

Understanding what causes spatial disorientation and illusions in flight can help you avoid losing control of your aircraft should these conditions occur. Section 8 of the *Aeronautical Information Manual* does a great job describing “Medical Facts for Pilots.” Additionally, here are some steps to help prevent you from losing your bearings when encountering illusions in flight:


- Before you consider flying at night with less than three miles visibility, get an instrument



Remember that if you see “red over white, you’re alright” and on the glidepath. And to aid in determining the proper roundout point, continue a constant approach descent until the landing lights reflect on the runway and tire marks on the runway can be seen clearly.

rating and maintain proficiency.

- At night or with reduced visibility, use and rely on your flight instruments. Test them before each flight.
- Maintain night currency if you intend to fly at night, and include cross-country and local operations at different airports.
- Study and become familiar with unique geographical conditions in areas where you plan to fly.
- Check weather forecasts before departure, while enroute, and at destination. Be alert for weather deterioration, especially at night.
- Do not attempt VFR flight when there is the possibility of getting trapped in deteriorating weather.
- If you experience a visual illusion during flight, have confidence in your instruments; ignore all conflicting signals your body gives you.
- If you fly single-engine IFR frequently, consider installing an alternate vacuum system or electric standby attitude indicator.
- At night, adjust the cockpit (and handheld device!) lights to a minimum setting so you are not hindered by reflections on the windscreen and windows or loss of night vision.
- If you have been able to see ground lights while flying enroute or descending at night, and then they disappear, consider pulling up immediately. You may have encountered a dark ridge or hilltop which lies in your flight path!

As mentioned at the beginning, night can be a great time to fly. Just be sure you gain — and maintain — the knowledge and experience you need to stay safe. 

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Learn More

Spatial Disorientation Fact Sheet

<http://1.usa.gov/1Cb4hmH>

FAA Spatial Disorientation Videos

<http://go.usa.gov/SAAH>