



Spatial Disorientation

NTSB accident data suggests that spatial disorientation may be a precursor to many general aviation accidents — particularly in night or limited visibility weather conditions. Instrument and VFR pilots are subject to spatial disorientation and optical illusions that may cause loss of aircraft control.

What Is It?

Sight, supported by other senses, allows a pilot to maintain orientation while flying. However, when visibility is restricted (i.e., no visual reference to the horizon or surface detected) the body's supporting senses can conflict with what is seen. When this spatial disorientation occurs, sensory conflicts and optical illusions often make it difficult for a pilot to tell which way is up.

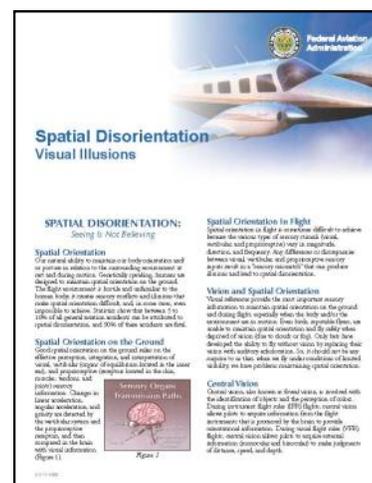
Contributing to these phenomena are the various types of sensory stimuli: visual, vestibular (organs of equilibrium located in the inner ear), and proprioceptive (receptors located in the skin, muscles, tendons and joints). Changes in linear acceleration, angular acceleration, and gravity are detected by the vestibular system and the proprioceptive receptors, and then compared in the brain with visual information.

In a flight environment, these stimuli can vary in magnitude, direction, and frequency, resulting in a “sensory mismatch” that can produce illusions and lead to spatial disorientation.

Some of these illusions can lure pilots in to making poor decisions or improper control inputs. For example, **aerial perspective illusions** may make you increase or decrease the slope of your final approach. They are caused by runways with different widths, upsloping or downsloping runways, and upsloping or downsloping final approach terrain.

An **autokinetic illusion** gives you the impression that a stationary object is moving in front of the airplane's path; it is caused by staring at a fixed single point of light (ground light or a star) in a totally dark and featureless background. This illusion can cause a misperception that such a light is on a collision course with your aircraft.

False visual reference illusions may cause you to orient your aircraft in relation to a false horizon; these illusions are caused by flying over a banked cloud, night flying over featureless terrain



Pilot Safety Brochure on Spatial Disorientation

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with ground lights that are indistinguishable from a dark sky with stars, or night flying over a featureless terrain with a clearly defined pattern of ground lights and a dark, starless sky.

How to Prevent Spatial Disorientation

You, the pilot, should understand the elements contributing to spatial disorientation so as to prevent loss of aircraft control if these conditions are inadvertently encountered. The following steps should help prevent spatial disorientation:

- Before you fly with less than 3 miles visibility, obtain training and maintain proficiency with flying by instruments.
- At night, or with reduced visibility, use and rely on your flight instruments. Be sure to test your flight instruments before each flight as well during your preflight and taxi.
- Maintain night currency if you intend to fly at night. Include cross-country and local operations at different airports.
- Study and become familiar with unique geographical conditions in areas in which you plan to operate.
- Check weather forecasts before departure, en route, and at destination. Be alert for weather deterioration.
- Do not attempt VFR flight when there is the possibility of getting trapped in deteriorating weather.
- If you experience a visual illusion during flight (most pilots do at one time or another), have confidence in your instruments and ignore all conflicting signals your body gives you. Accidents

usually happen as a result of a pilot's indecision to rely on the instruments.

- If you are one of two pilots in an aircraft and you begin to experience a visual illusion, transfer control of the aircraft to the other pilot, since pilots seldom experience visual illusions at the same time.
- If you fly single-engine IFR frequently, consider the investment of an alternate vacuum system or electric standby attitude indicator.

By being knowledgeable, relying on experience, and trusting your instruments, you will be contributing to keeping the skies safe for everyone.

Resources

FAA Spatial Disorientation Videos

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

FAA TV: Vestibular Illusions Pt 1

www.faa.gov/tv/?mediaId=462

FAA TV: Vestibular Illusions Pt 2

www.faa.gov/tv/?mediaId=463

FAA Pilot Safety Brochure: Spatial Disorientation - Visual Illusions

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

FAA Advisory Circular 60-4A, *Pilot's Spatial Disorientation*

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

