

**FAA OFFICE OF AVIATION MEDICINE
CIVIL AEROMEDICAL INSTITUTE
PUBLICATIONS
PILOT VISION**



Vision is a pilot's most important sense.

MOST pilots have are familiar with the optics of the eye. Before we start flying, we know whether we have normal uncorrected vision, whether we are farsighted or nearsighted, or have other problems.

And most of us who have prescription lenses--contacts or eyeglasses--have learned to carry an extra set of glasses with us when we fly, just as a backup.

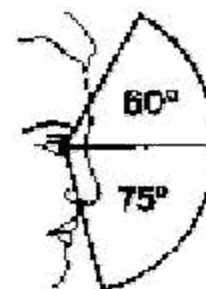
But, vision in flight is far more than a lesson in optics. Seeing combines the images that are received on the retina of the eye, and the signals that are

transmitted to the brain.

The Fovea

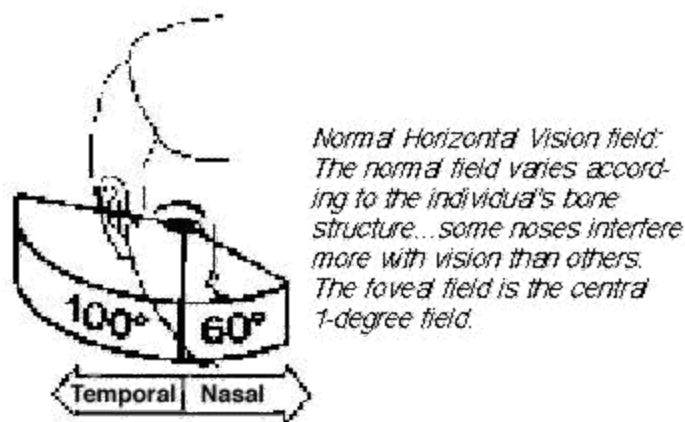
The fovea, the central part of the retina, is where our vision is most sharp. Few pilots realize how small this foveal field of vision is. It is a conical field of view of only about one degree.

To fully appreciate how small a one degree field is, and to demonstrate foveal field, take a quarter from your pocket and tape it to a flat piece of glass, such as a window. Now back off four-and-a-half feet from the mounted quarter and close one eye. The area of your field of view covered by the quarter is a one degree field, similar to your foveal vision.



Now we know that you can see a lot more than just that one-degree cone. But, do you know how little detail you see outside of that foveal cone? Your visual acuity (sharpness) drops off rather rapidly. For example, outside of a ten-degree cone, concentric to the foveal one-degree cone, you see only about one-tenth of what you can see within the foveal field. In terms of an on-coming aircraft, if you are capable of seeing an aircraft within your foveal field at 5,000 feet away, with peripheral vision you would detect it at 500 feet.

That's why when you were learning to fly, your instructor always told you to "put your head on a swivel," to keep your eyes scanning the wide expanse of space in front of your aircraft.



Focus and Distant Vision

We all know how important it is to be able to focus. Yet distance focus, without a specific object to look at, tends to diminish rather quickly.

If you fly over water or under hazy conditions with the horizon obscured, or between cloud layers at night, your distance focus relaxes after about 60-80 seconds. There is nothing specific on which to focus. So, your eyes revert to an intermediate focal distance that's a short distance in front of the aircraft!

The answer to this obviously limiting phenomenon is to condition your eyes for distant vision. Focus on the most distant object that you can see, even if it's just a wing tip. Do this before you begin scanning the sky in front of you. As you scan, make sure you repeat this refocusing exercise often.

Where to Scan

What you look for in your scan is also important. Most of us are instinctively alert for potential head-on encounters with another aircraft. Actually, a study of 50 mid-air collisions revealed that only 8% were head-on. However, 42% were collisions between aircraft heading in the same direction. So, compared with opposite-direction traffic, your chances of having a mid-air are over five times greater with an aircraft you are overtaking or one that is overtaking you.

Visual Anomalies

Visual anomalies, or illusions, are familiar to most of us. As kids, we learned that railroad tracks--contrary to what our eyes showed us--don't come to a point at the horizon. As a pilot, you must be aware of other illusions that can give you false cues: the aircraft near you that seems to be moving up or down as you change altitude. One of the special visual hazards of flying at night, "autokinesis," occurs when you stare at a pinpoint of light in a dark sky. After awhile, you get the feeling that either you or the light is in motion. To prevent this from happening, keep your eyes moving. Don't stare at a single light too long. A good technique is to look 10 degrees above, below, or to either side of the object.

The Eyes Have It

As a pilot, you are responsible to make sure your vision is equal to the task of flying--that you have good near, intermediate, and distant visual acuity because...

- Distant vision is required for VFR operations including take-off, attitude control, navigation, and

landing.

- Distant vision is especially important in avoiding mid-air collisions.
- Near vision is required for checking charts, maps, frequency settings, etc.
- Near and intermediate vision are required for checking aircraft instruments.

Learn about your own visual strengths and weaknesses. Changes in vision may occur imperceptibly or very rapidly. Periodically self-check your range of visual acuity by trying to see details at near, intermediate, and distant points. If you notice any change in your visual capabilities, bring it to the attention of your Aviation Medical Examiner.

And, if you use corrective glasses or contacts, carry an extra pair with you when you fly. Always remember: Vision is a pilot's most important sense.

SUMMARY

- THE SHARPEST DISTANT FOCUS IS ONLY WITHIN A ONE DEGREE CONE.
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- OUTSIDE OF A TEN DEGREE CONE, VISUAL ACUITY DROPS 90%.
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- SCAN ENTIRE HORIZON, NOT JUST THE SKY IN FRONT OF YOUR AIRCRAFT.
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- YOU ARE FIVE TIMES MORE LIKELY TO HAVE A MID-AIR WITH AN AIRCRAFT FLYING IN THE SAME DIRECTION THAN ONE FLYING IN THE OPPOSITE DIRECTION.
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Medical Facts for Pilots

Publication AM-400-90/2

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