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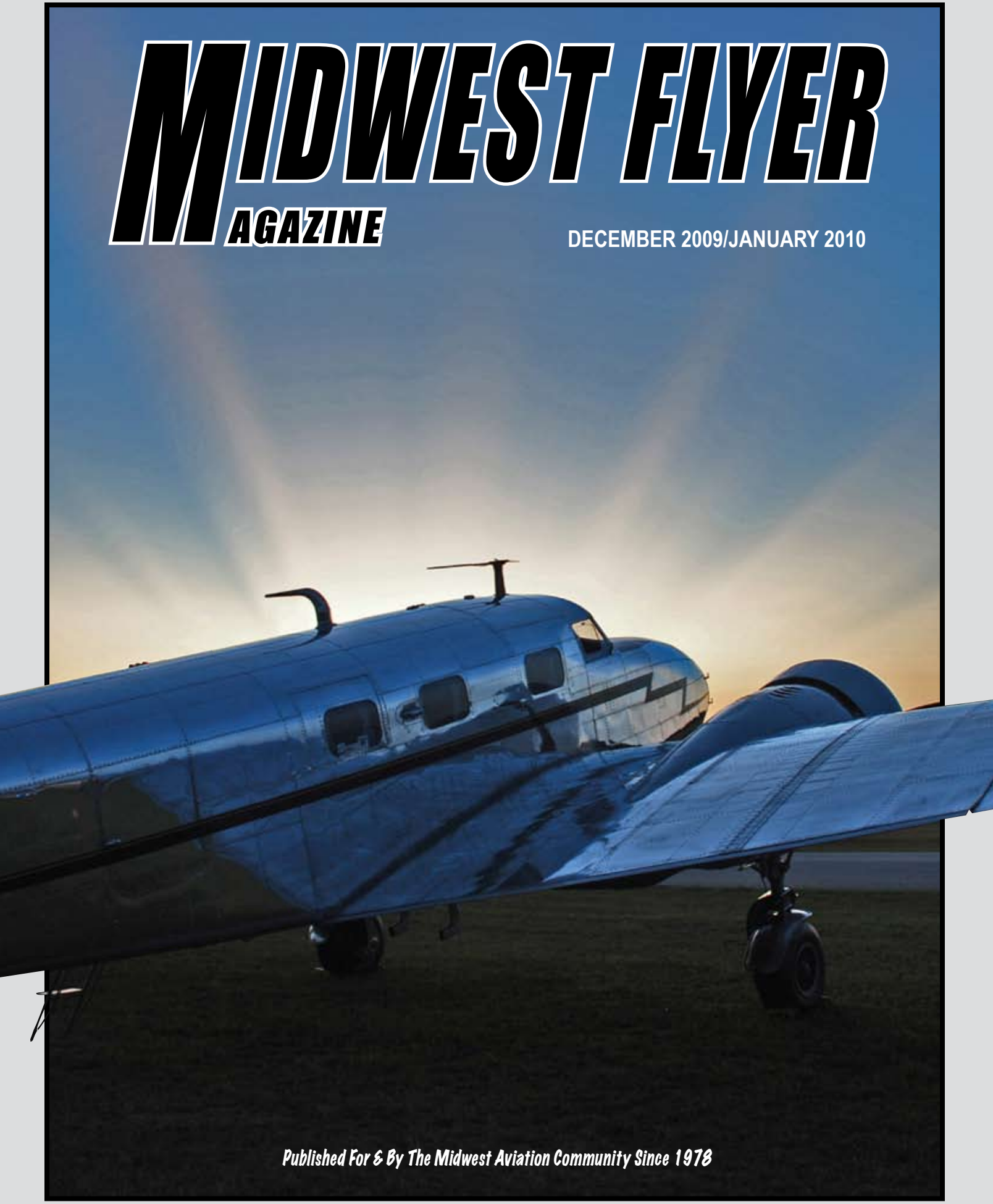

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# The Scan

## *Knowing What To Glance At & When*

*by Richard Morey, CFII*

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All instrument pilots have heard over and over again that the key to being a good instrument pilot is "the scan." This seems simple enough, but simple does not mean easy. Developing a good scan technique takes work, and knowing what to scan and when to scan is essential. The following tips should help you develop or refine your scanning techniques:

First, let's define what we mean by "the scan."

In instrument flight, you are substituting the view outside the window for gauges on the panel. Instead of looking outside for guidance, you are forced to interpret the instruments to manage your flight. Assuming steam gauges rather than a glass cockpit, you need to interpret more than one gauge to maintain situational awareness. This process is called "the scan."



### Glance, Do Not Stare!

This is good advice in many social settings, but is absolutely mandatory in instrument flight. Staring at an instrument, or "fixation" as the FAA calls it, stops the scan. This means we are not glancing at what we should be. The FAA calls this "omission." Without the scan, you no longer have situational awareness. Without situational awareness, you are behind the aircraft…reacting, rather than guiding. Let your eyes linger on an instrument only long enough to interpret the instrument, then move on.

### H A L Is Your Pal

This little mnemonic helps you keep your eyes moving and your scan going. H A L stands for Heading, Altitude, Looking for. Using this helps you keep ahead of the aircraft, and minimizes fixation.

"Heading" means, not only scanning for the correct heading, but tracking the navigation aid selected. Full panel: glance at the directional gyro and course deviation indicator. Partial panel: glance at the compass, the turn coordinator, and course deviation indicator.

An "Altitude" scan includes the altimeter, but can include the vertical speed indicator as well.

"Looking for" keeps your mind in the game and ahead of the airplane. In a turn, we are "looking for" a heading. En route or on approach, we may be "looking for" VOR passage, a vector from center, an intersection, a distance or perhaps interception of a radial, bearing or localizer. With every frequency change, "look for" the engine instruments as well.

### Don't Bite Off More Than You Can Chew

Another bit of good social advice. In flight, we should break down large tasks into small segments and scan in between. For example, instead of dialing in the entire new frequency while fixating on the radio display, tune one digit at a time and then scan in between. Another nice radio technique is to simply count the clicks while continuing your scan, then glance at the radio to confirm that you counted correctly and have the right frequency dialed in.

Assume we have to change frequencies from Madison (Wisconsin – MSN) tower, 119.3, to Middleton Municipal Airport, Morey Field's (C29) CTAF of 123.0. On my old KX170B, I simply grabbed the large tuning knob and counted four clicks clockwise. This advanced the frequency from 119 to 123. Then I would grab the little knob and count 12 clicks counter clockwise to go from .30 to .00. On the big knob, one click was one full MHz…the little knob was one click equals .25 MHz. Once you figure out your radio, you should have no problem changing frequencies with only a few glances for confirmation. This skill is guaranteed to wow your safety pilot, instructor or even examiner.

### Know Your Airplane

If you cannot close your eyes and put your hands on the engine controls, trim controls, radio tuning knobs and electrical switches, flaps, etc., you do not know your airplane. Taking your eyes off the instruments to locate and reach for a control breaks down the scan. Invest some time sitting in your aircraft on the ground with the engine off and practice until you get it right. This skill will lighten your workload both IFR and VFR and keep your eyes where they belong, on the instruments when IFR, or looking outside the aircraft on a good VFR day.

### Trim, Trim, Trim!

A good instrument pilot is a lazy pilot. Set the aircraft up with power and trim so it does what you want it to without control input. If you have to hold control pressure to get the desired result, then you do not have the aircraft trimmed properly. If you can let go of the controls and the aircraft continues as it was, you are properly trimmed. In cruise, an airplane that is not trimmed to hold an altitude will require constant correction. You may believe that you can hold altitude simply by keeping some pressure on the controls, but as soon as you are distracted, you will forget to hold the pressure allowing the aircraft to do what it is trimmed to do. More on trimming later, but remember, if you have to hold control pressures, you are working too hard. Be lazy, or if you would rather think of it as flying smart, that's okay, just remember to trim.

### Dynamic Flight & Static Flight

Instrument students often think of the scan as one all-encompassing technique that is appropriate for all phases of flight. The reality is one size does not fit all when it comes to scanning the instrument panel.

All flights can be broken down into two phases; dynamic flight and static flight. "Dynamic" phase of flight means we are in transition. We are starting or stopping a turn, a climb, a descent, or a configuration or speed change. Anytime we are in the dynamic phase, the artificial horizon should be the primary focus of your scan. "Static" phase of flight means we are in a steady state, be it straight and level, a constant airspeed climb, constant rate turn, or a constant rate descent. In static phases of flight, the artificial horizon plays a lesser roll. The primary instruments in static flight depend on the task.

### The Climb

Once established, a constant airspeed climb is a static phase of flight. In climb cruise, the emphasis should be on scanning the airspeed indicator and the directional gyro. A

reduction in airspeed will tell you that your aircraft's nose is higher than it had been, just as an increase in airspeed tells you your aircraft's nose has dropped. The airspeed indicator is your pitch instrument in a climb and as such deserves more of your attention than the artificial horizon. The directional gyro will tell you if you are drifting off course. This is often a result of insufficient right rudder, although inadvertent pressure on the control yolk (ailerons) can be the culprit as well. To avoid these problems make sure you keep the turn coordinator (both ball and wings) in your scan. Trim for the airspeed you desire and you will find that holding the assigned heading is easier as well. By not having to hold back pressure, you minimize the likelihood of deflecting the ailerons by mistake. Between the turn coordinator, directional gyro and airspeed indicator, you can easily hold heading and constant airspeed in a climb. The artificial horizon and vertical speed indicator are less useful in this phase of flight.

### Transition From Climb To Level Flight

Leveling off is a dynamic phase, and as such the artificial horizon should be primary in your scan. To level off, lead your assigned altitude by 10% of your climb rate. (Scan the vertical speed indicator for rate of climb, scan altimeter for lead altitude, and scan the directional gyro to hold heading). When you reach your altitude minus your 10% rate of climb lead, your eyes go to the artificial horizon and you apply forward pressure to the controls bringing the dot of the "aircraft" to the horizon line. Hold the dot on the horizon line with forward pressure on the controls keeping your wings level. As your nose drops, you will need a touch of left rudder to stay on course. As your airspeed increases, you will need more forward pressure to hold your assigned altitude. Trim off this pressure then begin to throttle back to your desired power setting, all the while keeping your eyes on the artificial horizon. Once you have trimmed off the forward pressure, glance at your vertical speed to verify level flight, glance at your directional gyro to verify you are still on your desired heading, glance at your engine gauges to verify you are at the correct power setting, and glance at your airspeed indicator as well. You will need to continue trimming the elevator until the aircraft has stabilized at the airspeed associated with the selected power setting and level flight. With the trim about right and the power set, fine tune the trim using the vertical speed indicator as primary. You should not be holding control pressure at this time. If the vertical speed indicator shows a climb, your eyes go to the artificial horizon and you adjust your pitch down a bit. Hold this attitude on the artificial horizon for a few seconds to allow the lag in the vertical speed indicator to settle out, then scan the vertical speed indicator. If the vertical speed indicator shows level flight, trim off any pressure you are holding, release the controls and see if the vertical speed indicator remains at zero. HAL scan, and repeat as necessary.

DO NOT CHASE THE VERTICAL SPEED WITH TRIM! You will not catch it! Instead use control pressure to establish and hold level flight, THEN trim the control pressure off. Remember, hold the attitude you desire, then trim off the pressure.



### Rudder Trim

If your aircraft has rudder trim, you need to manage that as well. It is useful to set the rudder trim for take off, then trim for cruise after leveling off. The ball is primary here. Hold pressure on the rudder pedal to center the ball, then trim off the pressure.

### Level Flight

Level cruise flight is or at least should be a static phase of flight. Emphasize the directional gyro and altimeter, with vertical speed indicator, turn coordinator (ball especially) as secondary with artificial horizon and airspeed indicator as least important.

### Turns

The turn consists of roll in (dynamic), the constant rate portion (static), and roll out (dynamic). To start a turn,

your eyes should go to the artificial horizon. You establish a bank angle with RUDDER and aileron. I emphasize rudder, as many pilots seem to forget this aspect of flight. Establish the bank angle appropriate to the rate of turn you desire. With a small heading change, a half standard rate turn will minimize the tendency to overshoot the heading. Once the bank angle is established, your eyes go to the turn coordinator to verify a coordinated standard or half standard rate turn. You are now in a static phase. Continue your HAL scan with emphasis on the directional gyro and turn coordinator with altimeter and vertical speed as secondary instruments. When you are 5 or 10 degrees from your desired heading (5 for half standard, 10 for standard rate of turn), your eyes go to the artificial horizon. You are about to enter a dynamic phase of flight. Again, using RUDDER and aileron, you roll your wings level and hold them there for a heartbeat or two to reestablish straight and level flight. Perform your HAL scan with emphasis on directional gyro and altimeter. Do not fixate on the directional gyro during the roll out! This is a common error among students. Ignore your inner ear and establish straight and level with reference to the artificial horizon. Just making the directional gyro stop for a bit, or believing your inner ear will not guarantee that you have stopped the turn.

### Vertigo

All instrument pilots will experience vertigo or spatial disorientation. This is normal and should be expected. One day you will roll out of a turn and your inner ear will tell you that you have rolled into a turn in the opposite direction. Or perhaps you will mistake the slight acceleration you feel when pushing the nose forward to hold altitude in an updraft as a pitch up. Pushing the nose down further will increase the acceleration, making you feel as if the aircraft's nose is even higher. The only way to overcome vertigo is to believe your eyes and interpret the instruments. In other words, scan. If your inner ear says you are in a turn, but your eyes interpret the directional gyro, the artificial horizon and the turn coordinator as indicating straight and level, what do you believe? The eyes have it!

*EDITOR'S NOTE:* Richard Morey is an 11,000-hour active flight instructor and the third generation owner of Morey Airplane Company in Middleton, Wisconsin (C29). Email cfiirich@tds.net, or call 608-836-1711.