Volume 24 Number 12
December 2008

IFR

The Magazine for the Accomplished Pilot

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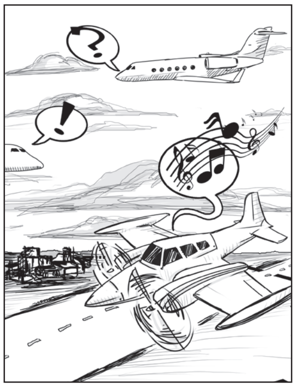

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FLAT LIGHT FLYING

When Mother Nature plays illusionist, knowing her tricks in advance may prevent you from being duped.

by Ken Holston

My high school driver's ed teacher once said something about the majority of auto accidents happening around dusk—something to do with rods, cones, and perception—but I was distracted by the cheerleaders practicing outside the window. Flat light can be the bane of pilots, too. We like to think in black and white, but when the light is neither day nor dark, our eyes might not correctly perceive objects. The key word is "correctly."

Officially mentioned in the FAA's 1983 update to AC-60-4A on Spatial Disorientation, the NTSB defines flat light as, "diffuse lighting that occurs under cloudy skies, especially when the ground is snow-covered."

Stopping there would be a grave mistake because flat light also lingers over water, in blowing dust, overcast skies, fog, and—as I've learned first-hand—in night-vision-goggle flying. Flat light also loves partial-moon nights, monochrome terrain (such as desert), and even summer haze. The phenomenon can encompass hundreds of square miles or the bubble of dirt around a hovering helicopter.

I bet most pilots would call this loss of correct perception "spatial disorientation." Although I agree, humor me and call it "spatial misorientation."

How do pilots counter flat light? They use two tactics: anticipation and routine.

When one thinks disorientation, it's by and large assumed to be a known issue, the sort-of white knuckler that makes your heart race. I'd argue, though, that the bulk of flat light illusions actually cause misorientation; the pilot innocently believes what he's seeing. As a result, the largest factor lost is time because recoveries aren't attempted unless a problem is recognized. Unfortunately, these mishaps often occur in the ever-important transitions during takeoffs and landings.

Don't Fall for Flat Light

How do pilots counter flat light? They use two tactics: anticipation and routine.

Think ahead during your weather briefing regarding flat-light factors. Is the airport in mountainous terrain where shadows fall well before sunset? Will winds stir up dust or will calm encourage fog? There are many causes, but part of being a graduate-level pilot is weather interpretation beyond the basics of simple ceiling and visibility.

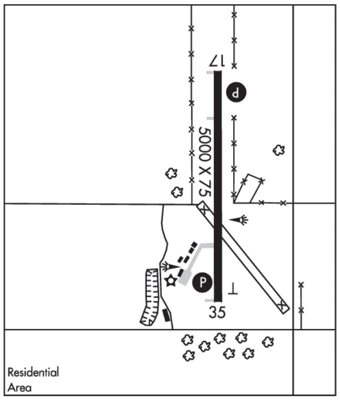
Compare and contrast runway lighting on the FAA diagram or the Jepp 10-9 page. When mulling over the approach choices, look not only at which plate provides the lowest mins, but which approach course best avoids terrain and lines up on the runway of choice. Avoid circling but remember that using higher-category minimums provide greater maneuver room and potentially add more buffer above obstacles. If no visual descent point (VDP) is offered, compute one (see sidebar).

During flight planning also seek an advanced level of preparedness. If this is a new destination, consider how a pilot accustomed to tall trees might normally be able to discern dwarf pines or desert scrub at midday but be insidiously tricked in flat light. Local pilots and the sectional chart are other ways to boost this area knowledge.

Below: *Unusually tall or short objects, or extra skinny or fat runways, on otherwise featureless terrain, make flat light that much worse.*

Right: *Airport diagrams are notoriously under-studied. Whether you expect to fly an approach or maneuver visually, review the lights and runway orientations you should see in those last three minutes of flying. Don't count on the NACO postage stamp to tell you everything. The AF/D may be more complete. Jeppesen users get a detailed picture on the airport diagram page.*

HILL CITY MUNI (HLC) 1 NE UTC–6(–5DT) N39°22.81′ W99°49.89′ **WICHITA**
2238 B **FUEL** 100LL TPA—3038(800) **H–5B, L–10H**
RWY 17–35: H5000X75 (CONC) S–12.5, D–16 HIRL 1.0% up N **IAP**
RWY 17: REIL. PAPI(P4L)—GA 3.0° TCH 40′.
RWY 35: REIL. PAPI(P4L)—GA 3.0° TCH 40′. Road.
AIRPORT REMARKS: Attended on call. For attendant, call 785–674–5613. Agricultural acft opr vicinity dalgt hrs. ACTIVATE HIRL Rwy 17–35, REIL and PAPI Rwy 17 and Rwy 35—CTAF.
WEATHER DATA SOURCES: ASOS 118.425 (785)421–3471. **HIWAS** 113.7 HLC.
COMMUNICATIONS: CTAF 122.9
WICHITA FSS (ICT) TF 1–800–WX–BRIEF. NOTAM FILE HLC.
RCO 122.65 (WICHITA FSS)
RADIO AIDS TO NAVIGATION: NOTAM FILE HLC.
(H) VORTACW 113.7 HLC Chan 84 N39°15.53′ W100°13.55′ 060° 19.7 NM to fld. 2690/8E. **HIWAS.**



Don't discount the preflight practice that PC-based simulators or online satellite imagery can provide. This study should allow you to build a mental picture of what an airport will be like although never having been there. Remember, one man's toy is another man's Mission Rehearsal Tool—it's all in perspective.

The last planning concern involves equipment. If you're flying with any inoperative equipment, pause and think through how this will affect the routine. Let's say GPS is out; with only legacy navaids, you'll have no groundspeed or database at hand. Or maybe the radar altimeter is on the fritz. The mission hacker in all of us commonly says, "No big deal" but thinking through how you will perform normal tasks with degraded equipment while mildly distracted (or worse) pays dividends once you're airborne.

With regard to things you can do from the cockpit, start with the basics: a clean windscreen and good quality sunglasses; some shades with "blueblocker" attributes have proven to help. Someone recently pointed out that downhill skiers have pine boughs placed along the edges of their runs to provide both visual contrast and a known object for referencing speed and slope. Similarly, while flying, search out contrast in what you see, particularly seeking reference items with familiar sizes and shapes, such as buildings, vehicles, water towers, etc.

Finally, let's say you're not quite prepared or are diverting to an unplanned alternate. The answer shouldn't be a shocker: Use your instruments. To be clear, continue to use a routine, habitual, instrument cross-check even after your brain is tempted to proceed otherwise. Avoid visual and/or circling approaches. By following segment and stepdown altitudes and—as I'm fond of saying— "staying on the black line," you are guaranteed obstacle clearance. Stick with vanilla routine.

Upon reaching the VDP or missed approach point (MAP) you must proceed visually. The simplest technique that I harp on is using groundspeed to compute a rate of descent approximating a three-degree approach path. To find this, divide your groundspeed in half and add a zero. For example: 90 knots cut in half is 45 and adding a zero makes 450 feet per minute. Using ground-

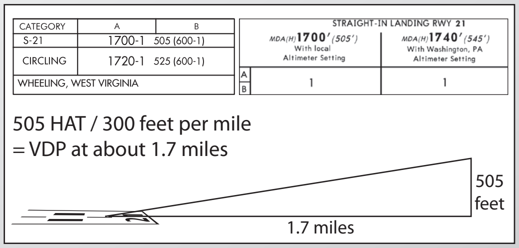
COMPUTING A VDP ON THE FLY

By picturing a three-degree slope beginning from touchdown and stretching out for miles, you can imagine that any point along the line can be identified by a unique pair of numbers; altitude and distance to touchdown. When flying a non-precision (or visual approach), the altitude is known, but deciding where this intercepts the path to the runway becomes the question. The answer is the visual descent point (VDP).

The easiest memory jogger for finding a VDP is "Granddad wears a HAT." Because hats always go "on top," then height above touchdown (HAT) over the desired gradient is the VDP in miles (HAT/Grad = VDP). For ease, use 300 feet per mile.

The HAT can be seen as the small number next to the MDA. If HAT was 505 feet, then 505 divided by the slope standard of 300 equals 1.7 miles from touchdown. (Height above aerodrome (HAA) will suffice for HAT when circling). So you'll want to start down when you're 1.7 miles from your desired touchdown point.

Putting this VDP to use requires finding 1.7 miles to touchdown. If GPS is counting down to the runway, life is good. DME can provide a reference, but consider the source. If the station is one mile off the far end of a 6000-foot runway, then touchdown DME will be 2.0. Adding the calculated distance makes the VDP 3.7 DME.



A last resort would be the use of timing. Let's say you cross an NDB 6.7 miles from the runway. Not only will the running clock count up to the missed approach point, but referencing the time elapsed to fly five miles will leave you 1.7 from the runway and darn close to a safe place to descend.

Note: A three-degree slope is 318 feet per mile and a nautical mile is 6076 feet. This is an estimation tool, though, not a NASA re-entry formula. *— K.H.*

THERE'S MORE THAN ONE KIND OF ARTIFICIAL HORIZON

I was on my way to teach the next lesson for an instrument ground school at a local airport. The topic du jour was the importance of a pilot's instrument scan. The hop from Baltimore (KBWI) to the other airport should have been a routine instrument flight. Little did I know the lesson I would learn.

Before I taxied out, I copied down Baltimore's information November. The weather wasn't too bad. The Baltimore ATIS was reporting a modest five-mile visibility. The ceiling was broken and variable between 800 and 1300 feet. The temperature and dew-point were a cool 4 degrees Celsius.

As I taxied, I noticed a little moisture began to form a cloudy band on the outer four inches of the windscreen. I had the defroster on high, although it didn't do much good around the edges. Upon reaching the run-up area, I used a towel to wipe the moisture off the inside of the window, only to see the moisture return after I completed my run up. I assumed it would eventually clear up as I got underway. With the outer edge of the windscreen still cloudy, I was cleared for takeoff by Baltimore Tower. I pointed the nose of the aircraft towards the clouds just like I had done hundreds of times before. This turned out to be anything but a routine climb-out.

Shortly after takeoff I noticed the attitude indicator showing a turn to the right. "That can't be," I thought to myself. I was having a lot of difficulty keeping the aircraft level. "What was happening?" Climbing at nearly 1000 feet per minute, I didn't have much time to sort this out before I was to enter IMC.

I could not figure out why the artificial horizon was showing a turn to the right when I knew I was level. I figured I was experiencing some kind of instrument failure. The suction gauge was right where it should be. Finally a cross-check to the turn coordinator showed I was, in fact, turning. I tried to focus outside to keep the aircraft level with the horizon, but this did not help. "What the $#@%! is wrong?" I said to myself. Am I disoriented? Experiencing vertigo? Indeed I was.

Not the Right Horizon

I was disoriented by the false horizon promoted by the band of moisture around the edge of the windscreen. That four-inch band of moisture changed my field of vision. I wanted to visually align the aircraft with this narrower-than-usual and misshaped window. Because of the variable ceiling, I was in instrument purgatory with one eye on the instruments and the other eye looking out the window. I hadn't completely made the switch to my instruments.

Even in the clouds it was hard to ignore the false horizon so clearly painted on my windscreen. I eventually followed that little voice in the back of my head that told me to trust the instruments. So I focused completely on cross-checking the instruments and continued to my destination uneventfully.

I couldn't help but incorporate my experience that evening into my instrument class. I told my students how easy it is to become disoriented when you trust what your body is telling you. Without solid visual references—or, perhaps, with solid but incorrect references—the transition to instruments on departure may need to happen long before you enter the clouds.

— Scott Dennstaedt

speed automatically compensates for wind and true airspeed changes. If you are not using this simple but valuable cross-check tool, you are simply in the wrong.

The Take Away

Training with a hood helps reinforce the mistaken black-and-white idea that one moment you're IMC and the next you're not. The real world, as many of you know, isn't always so kind. And just because the ASOS reports greater than six and clear, that doesn't mean your eyes will see the world with crystal clarity. Flat light is but one of a host of nagging traps Mother Nature sets to inspire our humility.

The airplane doesn't know how low the ceiling is. It only knows if it's on-speed or at a normal rate of descent. By making constant use of known pitch, power, and performance parameters you not only fly the airplane to a higher standard, but you reinforce a routine cross-check habit. This may even carry you past the point where a less disciplined pilot would have already been duped. If you do fall victim, you're more apt to recognize the misorientation and correct before it's too late. Thinking in black and white has its place, but I'd rather be prepared for the always expected shades of gray.

Ken Holston is an ATP, CFII, and USAF Advanced Instrument School graduate. He is also an IFR *Contributing Editor.*