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Photo by Susan Parson

TeachingTechnology

Instilling the
Right Aptitudes and Attitudes
for Safety

Today's pilots benefit from an astounding array of technology, both portable and installed equipment, that vastly simplifies the process of flight management from start to finish. In the preflight arena, technology gives us all kinds of new tools for weather, performance, and route planning. These and other apps and gadgets can vastly enhance en route situational awareness of changing weather, planned-versus-actual performance, airspace and, through Automatic Dependent Surveillance-Broadcast (ADS-B) In, or Traffic Information Service-Broadcast (TIS-B) traffic. At the end of a flight, apps and other new tools provide new ways to not just log time, but also to thoroughly document both pilot and airplane performance.

Technology and automation applied to an actively-managed flight can magnify its safety and efficiency, but when applied to a non-managed flight, they can very efficiently get you into very big trouble. That's because regardless of how good they are, today's avionics and handheld devices do not have sufficient intelligence to do more than exactly what we command them to do. If we issue the wrong commands because of inattention or incomplete understanding of the technology, the flight will potentially go off track in every possible way.

With that in mind, it is clear that flight instructors have a critical role to play in teaching pilots — both first-time applicants for a certificate or rating, and recurrent training clients — on how to make safe and appropriate use of the technology at our disposal.

Knowledge is Key

Improper understanding and/or poor management of technology can quickly get a pilot into trouble. I learned this lesson several years ago when my GPS programming mistake was about to command the autopilot into a 180 degree course change and a 1,000 nm deviation from the intended flight path. It seems I had wrongly selected the identifier for my intended destination, Augusta, Georgia (AGS), by accepting the system's presentation of AUG, which is the identifier for Augusta, Maine. The GPS didn't know the difference. The autopilot would have obediently pointed the nose in the opposite direction. I would have found myself confused and disoriented — "what's it doing?!" — while also doing some serious 'splainin' to an equally befuddled air traffic controller.

Knowledge and experience with each specific device is the key to avoiding this particular technology pitfall. A flight instructor is responsible for teaching not only the technology itself, but also for teaching the risks associated with its use while actively managing the risk inherent in instructional activity (especially one that involves any significant "heads down" time — more on that topic later). That means that both you and the pilots you teach need to know the equipment cold.

This process starts well before you climb into the airplane. When you teach the use of GPS moving map navigators, for example, consider assigning "box familiarization" homework that you will discuss during the preflight briefing. That homework should include both the manual and, if available, online simulators. Unless you already know the specific technology well, you need to do the same homework yourself.

Next comes the knowledge check. Before you go to the airplane, be sure that you both know how to navigate the mechanical structure (aka the "knobology") and the library structure — that is, how to efficiently find and display the information you need for any given phase of flight. You and the pilot you are training need to know the gadget's normal and abnormal operations, so you can avoid those pesky and potentially dangerous "what's it doing now" situations. You need to know what the technology can do for you and, equally important, what functions are simply beyond its capability.

Another preflight tip is to clearly establish your game plan. As the instructor, you need to have, and brief, an instructional plan of action for the technology you intend to teach — activities, exercises, locations, etc. While you might improvise in later stages of training, skip the surprise factor for a pilot just starting.

It's also important to have some version of what our military friends brief as "knock-it-off," which is a phrase that anyone in the exercise can use to immediately stop the action and reset. If you find yourself baffled, confused, or in any way uncertain about what the technology is doing, it's time to knock it off by turning it off to reorient yourself. That certainly applies to the autopilot, but it also includes panel-mount, hand-held, or tablet-based navigators if you don't understand where they are taking you, or if you have any doubts about the safety of the suggested course. Never forget that the magenta line, especially if coupled to an autopilot, can guide you direct to anywhere ... including direct through regulatory obstacles such as restricted/prohibited/controlled airspace, man-made obstacles, or natural ones such as terrain.

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Another tip: Even if you don't have cause to trigger your knock-it-off plan, consider creating one so as to firmly instill this concept in the pilot you are training. An ancillary benefit to this technique is giving the pilot opportunities to hand fly, and to quickly resume control of the aircraft in unexpected situations and circumstances, such as a missed approach.

Heads Up; Eyes Outside

I've heard moving maps described as both an eyeball vacuum and a time warp. From personal

experience, I can attest that both are true. Several years ago, I had just finished an enjoyable GA glass cockpit flight with an FAA colleague. During the postflight discussion, he made the following observation. "When it comes to programming the avionics, you know these systems as well as anybody I've seen. But you probably don't have any idea how much time you spent heads-down. There was a lot of traffic out there today."

That got my attention, which had admittedly been sucked into the vortex of the shiny multi-colored, whiz-bang gadgetry at my disposal. It was sobering to realize that, without even noticing, I had allowed all the pretty toys in the panel to distract my attention far too much and for far too long from the serious business of see and avoid. I've never forgotten the lesson, nor have I ceased to mentally replay my colleague's cautionary comment whenever I fly.

Never let the airplane or its on-board technology do anything you don't know about, or take you to any place your brain hasn't already passed through.

As I began to instruct more frequently in glass cockpit aircraft, I noticed that the eyeball and attention vacuum effect of the glass panel technology was not unique to me. My fellow pilots similarly fixate not just on periodic programming requirements, but also on monitoring the myriad bits and bytes of flight information on the various glass cockpit displays.

In an effort to offer them the kind of awareness my colleague gave me, I sometimes used a stopwatch to provide very specific feedback on how long they really spend in the technological time warp. The attraction to technological distractions is even greater now that so many of us have acquired extremely capable tablets stocked with equally capable flight planning, managing, and monitoring apps.

Yes, TIS-B and the growing proliferation of ADS-B equipped aircraft will certainly help with traffic spotting. Still, please don't allow pilots you train to lose the see-and-avoid habit.

Who's In Charge Here?

Our highly capable gadgets tempt us to shirk not only our see-and-avoid responsibilities, but also a vast swath of the flight management work. They lull us away from the discipline of critical thinking and true situational awareness, a term that implies far more than a position check on the moving map. When teaching technology, therefore, instructors need to instill habits that will keep pilots in control and in the loop.
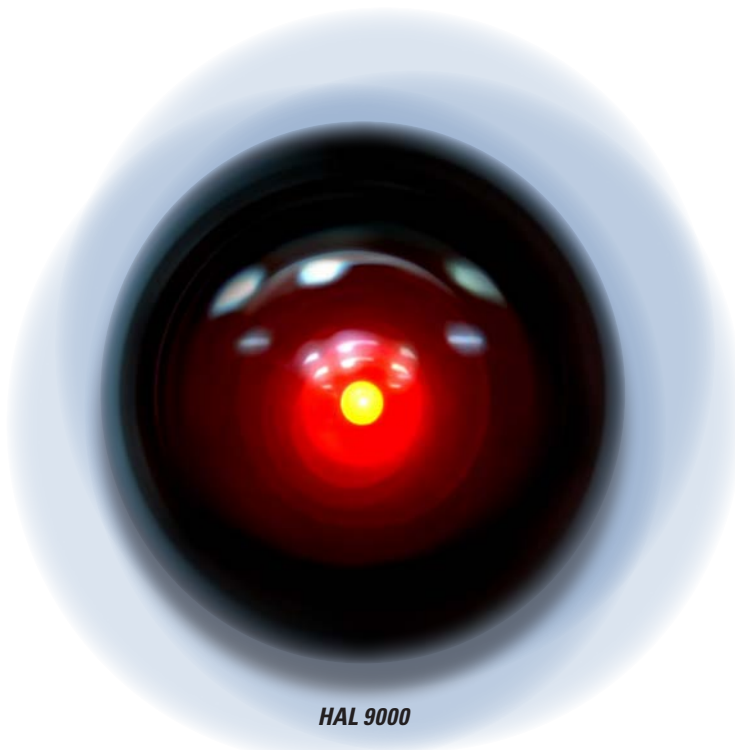
HAL 9000

Let's start with control. If you have ever watched *2001: A Space Odyssey*, you will remember the story of the spacecraft's domineering computer, HAL 9000. HAL asserts that he is "foolproof and incapable of error." At least initially, the crew is content to believe in HAL's infallibility and let their computer run the show. Even if you haven't seen the movie, you can probably guess that this decision leads to a bad end.

There is certainly astonishing capability and reliability in today's technology. Tablet flight management apps and panel-mount GPS moving map navigators provide an enormous range of information. Even the most modest GA autopilots can often manage stick and rudder duties far more smoothly than many human pilots. The problem is that we humans can be so beguiled by our electronic tools that we expect them to compensate for functions that we cannot, or choose not, to perform. We expect the technology to do not just the work, but also the thinking.

When we relinquish command and control functions to our on-board technologies, we implicitly delegate our PIC authority, and entrust our very lives, to mere machines. For that reason, one of the most important things to impart when you are teaching technology is that delegating the PIC role to on-board equipment provides a VFR-direct path to loss of situational awareness. As the instructor, you thus need to stress how both safety and good airmanship require the pilot to retain the role of PIC, and keep the technology under firm control. Never let the airplane or any of the on-board technology do anything you don't know about, and — as the cliché

reminds — never let the airplane or any of its high-tech equipment take you to any place your brain hasn't already passed through.

Now let's talk about staying in the loop.

To me, one of the great ironies of today's technological capability is that pilots can often be less aware of position than ever before. Here's why. When I was a student pilot making my solo cross-country flights in a C152 with only a single nav/com radio, my fear of getting lost motivated a near maniacal focus on positional and situational awareness. In addition to double-, triple-, and quadruple-checking the VOR frequencies and courses, I used pilotage to ensure that I could constantly match features on the ground passing below me to the proper location on my well-worn paper sectional chart.

GPS provides a much more precise position indication than anything I could have calculated in the pre-moving map Stone Age. Ironically, though, the advent of at-a-glance position awareness capability has sharply diminished the "where-am-I-now" discipline that was the hallmark of being in the loop. When you don't have to put any mental effort into ascertaining positional awareness or, if you use an autopilot, actually flying the airplane, it's easy to stop paying attention.

As the instructor, you therefore need to teach techniques to help pilots stay in the loop. The act of speaking and writing bolsters awareness, so you might require them to do things like consistently use callouts to maintain positional awareness (e.g., "crossing WITTO intersection, next waypoint is MITER intersection"); annunciate changes to heading, altitude, and frequency; record those changes in an abbreviated navigation log; annunciate any change to navigation source (e.g., "switching from GPS to VLOC") and autopilot modes; and read each item on the autopilot status display aloud every time there is a change, stating which modes are armed and which modes are engaged.

Today's technology provides the foundation for an unprecedented level of situational awareness. For everyone's benefit, please teach your pilots to use it wisely and well. ✈

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