



SABRINA WOODS

# SURPRISE!

## *Combating the Startle Effect*

Who doesn't like a good surprise? Like the kind when someone you care about meets you somewhere unexpected, or when you receive a nice treat from out of the blue. Those surprises are almost always welcome, but when the "surprise" comes at 5,000 feet and going 100 kts, it can often lead to mishap. Between 2001 and 2014, over 40 percent of fixed wing GA accidents occurred because pilots lost control of their airplanes during various phases of flight. The "startle effect" has definitely played a prominent role in many of those accidents.

For many pilots, the cockpit is starting to be quite a busy place as more and more technological upgrades are introduced. Dazzling electronic and LCD flight deck arrays are replacing traditional analog gauges. Electronic flight bags (EFB) can tell

you almost everything you want to know with a single finger swipe. ADS-B In and Out monitor traffic. Once you've hit that desired altitude and cruise speed, an autopilot can take over, leaving you to sit back, relax, and observe the progress of your flight.

Everything is perfect. That is, until your autopilot switches off for a reason unknown to you and you don't realize it. Or that electronic array goes out leaving you, quite literally, in the dark. Or an aural warning from your terrain avoidance system sounds and doesn't correlate with what you think to be true. Or worse, the stick starts rattling violently, desperately trying to get your attention even as you cannot identify the reason why. These are all nasty surprises that have been suspected causal as the factors in a loss of control in-flight (LOC-I) mishap.

## What is the Startle Effect?

To “startle” is the result of a sudden shock that can disturb or agitate the recipient. Also known as the “limbic hijack” or colloquially as “fight or flight,” it is a response to an unexpected stimulus. The limbic center is that part of our brains that rules our reactions to things — typically, without the benefit of any additional logic or reason. The result of limbic hijack can cause a person to have an involuntarily physical reaction (e.g., jerking back on the yoke), can induce a significant emotional or cognitive response (e.g., fear, confusion, or anger), or can simply cause a person to freeze in place. In the latter, inaction can often exacerbate a problem just as much as failing to provide the right corrective action can.

Automation or aviation startle occurs when something in the aircraft suddenly deviates from its expected performance, resulting in one of the aforementioned responses. The startle effect can lead to distraction or fixation, which can lead to calamity. In one tragic example, a Cessna 421 *Golden Eagle* on a nighttime instrument meteorological conditions (IMC) flight over terrain experienced a vacuum pump failure at approximately 27,000 feet. The post-mishap investigation revealed that the autopilot was also likely malfunctioning, possibly forcing the pilot to take manual control of the aircraft. In the confusion, the pilot subsequently lost control and dove 10,000 feet before an in-flight break-up commenced.

Automation startle typically follows one of two gambits. The first is the “without warning” surprise that can leave you completely unaware of what is actually happening. The second is what I call the “three-alarm-fire” scenario. This is when an alarm (or several) goes off and it can be even more jarring than the problem itself.

## Without Warning

When the cockpit voice recorders were finally recovered from the lost Air France Flight 447, they revealed that the last words of the crew were “... we’re going to crash! This can’t be true. But what is happening?” The flight entered the waters of the Atlantic Ocean at a tremendous rate and the crew never fully understood what was happening to them.

While we rarely have the benefit of CVRs to study in general aviation mishaps, there is no doubt that the “What is it doing *now*?” sentiment prevails in many. This “without warning” form of automation surprise is insidious, can sneak up on you and put you in a precarious situation before you have a full grasp of what is happening. While automation is a wonderful

tool, it can sometimes lull you into complacency. You believe everything is going as it should, because why wouldn’t it? Incidents born of this category of automation startle are typically the result of failing to carefully monitor cockpit instruments and gauges, and missing when something goes wrong.

Luckily, prevention is really very easy. Benjamin Franklin is credited with observing that “An ounce of prevention is worth a pound of cure.” So first and foremost, ensure you and your bird are ready to go way before you ever get wings aloft. Running your personal minimums checklist, making sure you are mentally and physically ready to fly, and conducting a solid in-depth preflight are just parts of this. These are the steps that can make sure nothing goes wrong later.

Next, it is all about the scan. Monitor those gauges; don’t take them for granted! Practice your desired scan pattern on the ground so it becomes second nature, then stick to it in the air. Even though many of the latest advancements help take the burden of manual flying, it is your job to continuously observe and monitor the execution of things. A careful scan should help you pick up quickly when something stops working as it should. It also gives you much more time to deal with the situation.

Deviating from your scan or fixating on just one instrument or gauge can mean you might miss something, or worse, can lead to spatial disorientation — another common catalyst for loss of control. In a very well-known fatal mishap, John Fitzgerald Kennedy Jr. was flying in hazy weather at night over water. He likely succumbed to spatial disorientation when what he thought to be true differed greatly from what was actually happening. He eventually lost control of his Piper *Saratoga* and crashed just off the coast of Martha’s Vineyard. None of the three on board survived.



Photo by Tom Hoffmann

***Maintaining a careful scan should help you pick up when something stops working as it should.***



Photo by James Williams

Should you ever encounter a conflict between what you think (and feel) is happening and what your gauges say, go with the gauges. Remember, there are no red bars or warning lights for the human body when it has been compromised.

### Three-Alarm-Fire

While in cruise flight, the pilot of a Raytheon A36 (Beechcraft Bonanza) was switching fuel tanks when the engine suddenly lost power and several gauges illuminated with warning indicators. While he was busy trying to interpret the gauges and troubleshoot the issue, the pilot failed to continue flying the aircraft. At one point, ATC radioed the pilot to advise

that he was “flying in circles and losing altitude.” Alarmed, the pilot thought the plane was in a spin. As he struggled to regain control, he entered a stall

and wound up crashing into a cornfield at a high rate of speed. The pilot, although seriously injured, survived the mishap. This is an example of what I call the three-alarm-fire; a situation in which so many things are happening at once that a pilot can become overwhelmed and lose focus on the core issue.

Several preeminent human factors specialists have recently theorized that an alarm might result in worse distraction to the pilot than the underlying issue (i.e., the reason for the alarm). The alarm startles the pilot and diverts attention from the priority of flying the airplane. For instance, the “stick shaker” is highlighted as being the single most disruptive warning, often triggering a fight or flight response. Although some would argue that “scaring the daylights” out of a pilot is exactly what it was meant to do, others agree that alarms are meant to point you in a direction that needs attention, not put you in cardiac arrest.

While these new theories are being considered in the latest rounds of aircraft design and manu-

facturing (e.g., alarms featuring a gradual run up instead of the startle) you can prevent this form of automation surprise from getting the best of you by preparing ahead of time. Recognize the failure modes of your instruments and systems and read up on what they mean. You should be very familiar with all the contents of your airplane’s Pilot’s Operating Handbook or Airplane Flight Manual.

Prior experience can often be the best mitigation tool. Many of the scenarios that lead to mishap arise from problems the pilot has never encountered, so there is no ready response. Developing and running through scenarios and corrective actions with a CFI, possibly in a flight training device is a great way to build some of that experience without actually being in a real-life situation where the learning curve (and consequences) gets immensely steeper. Last, just in case the initial situation ever does get away from you, another great idea is to invest in upset recovery training. It is a great opportunity to receive ground and hands-on training that might prove invaluable later.

### Maintain Good SA

Simply put, the best way to avoid nasty surprises once in the air is to maintain constant awareness of what is going on around you. Aviation situational awareness (SA) is equal parts information gathering, painting a mental picture, and anticipating what might happen, and then using all of this data to control the aircraft. In the information gathering phase, your scan, plus any additional information you glean from traffic and weather reports, help you build that all-important sight picture. With that picture, taking time to consider what might go wrong at each crucial interval helps you to be ready to spring into action if needed. 

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