

SURPRISE AND STARTLE

Surprise and startle are words often used in the same breath. However, for several important reasons, the distinction should be clearly understood. In this article, **Captain Ed Pooley** explains some of the differences.

Surprise and Startle Response are Different Reactions

Surprise is *"an emotion typically resulting from the violation of an expectation or the detection of novelty in the environment"* (American Psychological Society, 2022). The startle response, meanwhile, is *"an unlearned, rapid, reflex-like response to sudden, unexpected, and intense stimuli (e.g. loud noises, flashing lights)"* (APA, 2022), a response which is sometimes colloquially described as 'fight or flight'. Surprise and the startle response are associated with fundamentally different neurological and physiological activity.

Simply put, surprise is a mismatch between expectations and reality, or something that is very unusual, while a startle response is associated with the almost instantaneous perception of a threat. An everyday analogy may occur on one's birthday. A surprise might be

receiving a card or gift from an old friend whom you thought you'd never hear from again. A startle response might occur if you walk into your dark home to find all the lights switched on suddenly and several friends jump out from behind the furniture in your living room.

For pilots, an extremely small number of sudden unexpected situations are likely to trigger an immediate and involuntary 'startle reflex' in one of the pilots. It has been shown that this is quite likely to be followed by an irrational response, which is recognisable as such by the other pilot who is unlikely to be similarly affected at the same time. The available evidence indicates that a startle reflex that results in hazardous direct or indirect inputs to the primary flight controls – the most serious consequence – is most likely to occur during a relatively quiet period of flight and when no external visual reference is

available (e.g., when in cloud or during dark night visual conditions over terrain with no significant lighting).

Research indicates that the activation of a startle response may directly affect information processing capability for up to 30 seconds and thereby have important implications for the affected individual's situational awareness and decision-making ability. It also appears that once this acute phase is over, a variable duration phase of continuing disruption to normal performance is likely.

Surprise is Common, Startle Response is Rare

Almost all encounters with a sudden unexpected in-flight situation may constitute a 'surprise' to one or both pilots in a multi-crew aircraft. Dramatic improvements in aircraft reliability and widespread compliance with comprehensive normal procedures mean that surprises are now fewer than in the past so that dealing with them is no longer an almost everyday experience. Nevertheless, the element of surprise is still at the core of a significant proportion of those occasional unwanted events.

The startle response to an unexpected or threatening event is so rare that most pilots will be able to complete their career without experiencing it themselves or having to react decisively to the consequences of a colleague experiencing it. In my own flying career, I did not experience a startle reflex at any time. Nor did I witness any of my many fellow pilots being so affected. I don't think my experience is particularly unusual. Few pilots will even know anyone who has had or witnessed a startle reflex event during flight.



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Risk Mitigation of Surprise and Startle is Fundamentally Different

Startle reflex is not simply 'extreme surprise', and the recognition of the difference is important for risk management. Although it is not easy to replicate surprise realistically in a full-flight simulator, it can be achieved with a little imagination and at the expense of more simulator time than the typical regulatory minimum. Effective mitigation of the risk for the relatively common 'surprise' reaction with no startle response for either pilot is increasingly being provided. Exposure to unexpected events during training sessions (in ways other than those routinely included) has been shown to be effective in reducing the risk of a non-standard response. Surprises alone leave time for a considered and rational response and are thus unlikely to need a change of control as an immediate response, or indeed as any part of the resolution.

Effective mitigation of the risk of those rare events that trigger a startle reflex-based response is more problematic since they are very rare. The propensity

of individuals to experience startle response is variable and in respect of pilots in flight (which may or may not be different to the same propensity in other contexts) cannot be assessed. It has not yet been demonstrated that simply exposing pilots to *surprises* in a training environment can affect what is a physiological response. What is likely to be beneficial is enabling all pilots to distinguish a (rare) startle response in an unexpected situation from (much more common) surprise. This can help an unaffected pilot to recognise when their colleague has been affected and is unknowingly responding in a way that is leading to an unsafe condition requiring intervention. The importance of the Pilot Monitoring (PM) – especially if they are the junior crew member – having the confidence to act without delay, if necessary, cannot be overstated.

Remember that a Pilot Flying (PF) experiencing a startle reflex response will not recognise it themselves, so any attempt to engage normally with them will be temporarily impossible. If continued safe flight is being compromised, then the unaffected pilot must be prepared to intervene without delay and quite probably take over control temporarily. If the task of any such takeover of control falls to the junior pilot, then an unusually direct instruction may be required to retrieve the situation before it gets too difficult to do so.

Confusion about the important distinction between surprise alone and unexpected events that trigger a startle reflex response is widespread, and has important implications for risk mitigation training. Such confusion is evidenced by the fact that many pilot reports of 'surprise' events use the word 'startle' when it is clear from the narrative that no startle reflex occurred.

Find Out More

To understand the startle reflex as it affects pilots, I recommend Safety Briefing Note 06 on *The Risk of Startle Reflex* published by the Honourable Company of Air Pilots, an independent organisation which works to assist air safety (see references). This was issued in November 2021 and drafted by a global steering group of very experienced pilots, then finalised and formally approved only after peer review by around 70 other similarly qualified pilots. After it was sent directly to thousands of pilots working for commercial air transport operators worldwide, no adverse response was received.

Finally, if you prefer a different medium, a short (two minute) SKYclip showing a successfully resolved startle reflex scenario can be viewed at <https://www.skybrary.aero/video/startle-effect-skyclip>. 



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References

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The Honourable Company of Air Pilots (2021, 10 November). *The risk of startle reflex*. Air Pilots – Commercial Air Transport Safety Briefing Note 06. London: The Honourable Company of Air Pilots. <https://skybrary.aero/sites/default/files/bookshelf/32700.pdf>