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STARTLE & SURPRISE MANAGEMENT

Startle and surprise management are essential for staying in control. Building on previous research, James Blundell, Jeroen van Rooij, Annemarie Landman and Daan Vlaskamp present an operational evaluation of a self-management method designed to mitigate the cognitive and physiological impacts of these responses, offering new insights into its effectiveness in flight.

"While distinct, startle and surprise can occur together and both produce incapacitating cognitive and physiological effects that impair pilot performance, communication and decision-making."

- **Startle and surprise:** Startle is a reflexive response to intense stimuli, while surprise is a cognitive-emotional reaction to unexpected events. Both can impair pilot performance, decision-making, and communication, and can occur together.
- The Reset method: A self-management method called "Reset" was evaluated, which helps pilots recover from startle and surprise. It involves physical distancing, breathing techniques, muscle relaxation, and checking the well-being of fellow crew members.
- **Pilot experience:** Pilots found the Reset method useful for managing stress and improving situational awareness, with the breathing technique and checking on colleagues being the most valued steps.
- Challenges: The main challenges in applying the method included the urgency to act during emergencies, difficulty admitting being startled or stressed, and environmental factors such as noise and turbulence.

A previous issue of *HindSight* (issue 34) was dedicated to the handling of surprise, caused by unexpected events. Surprise is a cognitive-emotional response triggered by a mismatch between our expectations and reality, such as unexpected automation behaviours, which endures for as long as a cognitive mismatch persists.

On the other hand, startle is the far more transient reflex-like response to intense physical stimuli that can be triggered by both expected and unexpected events (definitions adapted from https://dictionary. apa.org/startle-response). While distinct, startle and surprise can occur together and both produce incapacitating cognitive and physiological effects that impair pilot performance, communication and decision-making (Martin et al., 2016). Both are thought to have contributed to aviation incidents and accidents.

HindSight 34 featured two articles on recent research into startle and surprise self-management methods for pilots, which can help mitigate the related cognitive and physiological impairments and expedite the recovery of performance. Simulator research has shown that these methods can improve pilot decision-making performance and are considered useful by pilots (Field et al., 2018; Landman et al., 2020). In this article we present follow-up research, consisting of the first evaluation of such a method in operational practice.

The evaluated method is based on the method detailed in the article 'Training for Surprises', in *HindSight* 34. The method does not distinguish between startle and surprise. Both often present simultaneously, and pilots regularly do not distinguish between



Ten pilots of a major European airline were interviewed about their startle and surprise (S&S) experiences in real-life and training experiences. In addition, pilots described their experience with applying the startle and surprise management method, which their airline had implemented since 2018. The method is part of a wider 'non-normal strategy', which places the method after the steps of 'protecting yourself' (e.g., donning an oxygen mask) and bringing the flight path under control. The method itself is called 'Reset' and consists of the following 5 steps:

- 1. Announce to the other crew member(s) that a 'Reset' will be performed.
- 2. Take physical distance: push back into the back of the seat.
- **3.** Perform an abdominal breathing technique: take a deep breath, and exhale slowly. Repeat if necessary.
- 4. Tighten and relax muscles.
- 5. Check the wellbeing of the fellow crew member(s).

The method is followed by systematically building situational awareness, by calling out all observed indications of the problem. The aim is to avoid rushed decision-making. Transcripts from the interviews were analysed using thematic analysis. This produced five themes that summarised the discourses with the pilots, described below.

EFFECTS OF STARTLE AND SURPRISE

Pilots reported both physical effects (e.g., increased heart rate) and psychological effects (e.g., tunnel vision) during startle and surprise. "You feel the adrenaline" said one pilot. Some described surprise experiences were associated with significant distraction: "having [no] control over ... thoughts and the stress that caused". A pilot described surprise in his colleague: "he felt a bit stuck" and "I had to pry the information out of him".

Startle and surprise were not often experienced in the simulator, as non-normal situations are expected, sometimes *"scenarios are known in advance"*, and the simulator feels more *"artificial"*.

BENEFITS OF USING THE RESET METHOD

All interviewed participants were positive about the Reset method and most had used it. Participants said that they found it effective, and one noted that it *"helps to find calmness"*. Benefits in perception and comprehension were reported. For example: *"we noticed a warning light that we didn't notice before"* and *"it felt like my brain was plugged in again."*

An unexpected benefit was the method's general stress management application. It was reported to be useful during: *"a busy day with lots of disturbances on the ground"* and in a *"dense fog situation at home base."*



ELEMENTS OF THE METHOD USED

Pilots did not always use the full method. "We didn't call it startle and surprise. We just asked, 'are you ok?"" said one participant. The element that was reportedly least used was the "tense/relax muscles" step. Most used were the breathing technique and the step "check colleague". Supporting Field et al. (2018), this element is valuable in several cases where a colleague is startled or surprised and crew situation awareness was compromised: "I asked how are you? And then I realised this event startled him a lot.... He thought this was all [his] fault. ... If I hadn't asked this question, we would have remained [a] 'split cockpit'. ... He was still too focused on what was going on."

BARRIERS TO USING THE METHOD

Some pilots noted difficulty admitting being startled, surprised, or stressed, for fear of being seen as incompetent: *"It is a bit of a tough-*

guy culture", said one participant. In addition, a desire to take quick action, rather than employ the method, was a recurring comment: "It feels that valuable time is lost", said one pilot, and another noted, "you are so full of adrenaline and stress that I don't see where to fit it in."

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Interference from environmental factors (e.g., noise disrupting verbal communication) were highlighted by two participants. In one case, strong turbulence at low altitude was mentioned: "If it's so turbulent that you can't read the instruments, I don't know if you can do a reset."

The opinion that the method was associated more with startle than surprise was voiced. *"Perhaps it's overkill for surprise."* This may be due to surprise having no clear 'trigger', which makes it hard to recognise. Also, pilots often used the terms interchangeably, so this observation should be treated with caution.

TRAINING

Simulator upset recovery training was voiced as being a situation where exercising the method was difficult due to not being sufficiently addressed: *"I've never seen it used"*, said one instructor.

Based on simulator experiences, the procedures following decompression (emergency descent) were felt to leave little room for performing a Reset: *"In case of a decompression, it is fine to be startled, but you really have to go down as quickly as possible, especially when at FL410."* It is a complicated procedure for a situation that usually occurs suddenly, unexpectedly and with a

startling or surprising stimulus (such as a cabin warning horn or a bang), where several memory items must be performed and where communication is hampered by oxygen mask use and the potential of hypoxia.

Pilots mentioned possible training improvements about S&S recognition in oneself and, importantly, in the other pilot. Also, *"sharing real experiences"* and having fellow pilots recount the benefits of using the method in actual emergency situations were suggested as approaches to address resistance in training.

FOLLOW-UP RESEARCH

After the interviews, a questionnaire survey was conducted among the company's pilots. Its findings confirmed the results from the interviews. In brief, 239 pilots responded and 91% had experienced startle or surprise during a flight. Eighty seven percent felt better prepared for S&S situations and 39% had used the method in reallife S&S situations.

CONCLUSION

Both the interviews and survey confirmed previous simulator-based research that S&S management methods are much appreciated by pilots, and are perceived to reduce stress and improve situational awareness and decision-making. Critically, no pilot reported experiencing negative effects from using the method. The most useful elements of the tested method were the breathing technique and checking the mental state of one's colleague. Following up with careful building of situation awareness is an important next step.

The main barrier to using the method during actual flight operations was the urge to take immediate action. A threatening stimulus takes priority over performing these methods through the human urge to eliminate the threat. This can impair perceptual

processes and cause cognitive tunnelling. It can also increase the likelihood of incorrect and rushed decisions (Field et al., 2018).

The paradox of startle is that the higher the stress level and the more a management method is needed, the more difficult it becomes to initiate a method. The reported difficulty in recognising "The paradox of startle is that the higher the stress level and the more a management method is needed, the more difficult it becomes to initiate a method."

the effects of startle and surprise might also be a consequence of this effect. This reinforces the importance of the step of checking the fellow crew member's mental state.

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As startle and surprise are a common occurrence, a well-trained self-management method is a very useful tool for pilots to have.

TRAINING RECOMMENDATIONS:

- The effect of the 'startle paradox' during pilot training of startle and surprise management methods should be explained to pilots: the more stressful a situation is, the stronger the urge to skip these methods.
- They should be trained in a variety of difficult situations, to emphasise appropriate timing, especially in situations that require urgent action.
- When introducing startle and surprise management methods, they should be kept simple and short, as they have to be performed in situations with a high cognitive load.
- For upset recovery training, using the method post-recovery will prepare pilots for possible subsequent events by diminishing the detrimental cognitive effects from accumulated stress (Landman et al., 2020). A thorough introduction (see *HindSight* 34) will help with acceptance.

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