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TRAINING FOR SURPRISES

RESEARCH AND IMPLEMENTATION

Training is a critical part of dealing with surprises in the flight deck. **Jeroen van Rooij** and **Edzard Boland** report on a research project by NLR and KLM to develop training to help pilots to maximise performance in every unexpected situation.

KEY POINTS

- **In a research project funded by EASA, the Royal Dutch Aerospace Centre NLR and Royal Dutch Airlines KLM developed, evaluated and implemented pilot training for the recovery of surprise effects.**
- **The goal was to develop a training programme helping pilots to develop knowledge, skills and attitudes usable in every unexpected situation to maximise performance.**
- **Part of the training is a recovery technique. This technique (ROC; Relax, Observe, Confirm) is relatively simple. However, a thorough training and implementation plan for application of the technique in unexpected situations is needed.**
- **Feedback from pilots after the training and after actual application during simulator sessions or operational flight has been positive.**

Even in a highly standardised commercial aviation world, unexpected events are a fact of daily life. Mostly, these cause just a minor distraction, but sometimes they have significant detrimental effects on crew performance. In the aftermath of the Air France 447 and ColganAir 3407 accidents, EASA instigated research on the impact of startle and surprise on pilots, and developed potential training interventions. In this research project (EASA, 2018), the NLR and KLM developed and evaluated pilot training on the recovery of startle and surprise effects, which could also be of use for cabin crew, ATC and other (non-aviation) domains. By combining the NLR, a research institute, with KLM, it was possible to develop a scientifically based and practically implementable training intervention.

Several incidents and accidents in the past couple of decades, such as the

ones mentioned above, have taught the industry that in complex and dynamic situations, pilots cannot rely solely on procedures, rules, and automation. Different approaches have been suggested on how to manage such situations. One of those approaches is a shift from proceduralised, task-based training to a more competency-based approach using a wide variety of training scenarios (see Landman, et al, 2017). The aim is to provide pilots with knowledge, skills and attitudes that can be applied broadly. This resonates with the Safety-II idea that in a complex and dynamic environment, the human is the strongest link, possessing the flexibility and creativity to deal with unforeseen events. The assumption, however, is a normally-functioning individual. The effects of startle and surprise can seriously impair normal functioning. As surprise is much more common than startle, the research focused on the former.

Surprise Effects

Surprise refers to a mismatch between expectations and reality and can have multiple effects. Among these are physiological effects such as increased heart rate and blood pressure and inhibited fine motor skills, cognitive

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effects such as narrowing of attention and impairment of working memory, and emotional effects such as confusion and fear. All these effects, especially combined, can create a sense of urgency to take action, which in some cases may be associated with the 'fight or flight' response. This can have significant negative consequences on the decision-making process, possibly leading to rushed or wrong decisions.

For the pilot, and for any operator in highly dynamic and safety critical situations, it is paramount to recover from these negative effects as soon as possible to be able to apply all competencies, maximising performance. Therefore, the research team focused on a strategy to manage the effects of surprise: Relax, Observe, Confirm (the situation).

Relax

In cooperation with a performance psychologist, techniques already in use in other domains (such as sports and the military) were scrutinised for practical use in an airline cockpit. As a result, the team evaluated if the following techniques could be beneficial to overcome the effects of surprise:

- taking physical distance (pushing and consciously feeling one's back in the chair),
- a simple breathing technique, and
- muscle relaxation.

Instead of the old slogan 'stay calm', an active way of controlling emotional and physical effects was chosen, thereby shifting the focus from the situation towards the body. The hypotheses were that this 1) reduces the chance of aggravating the situation by making rushed decisions or inputs to the aircraft, and 2) enables the pilot to perform at their best by reducing stress.

The next step in the strategy is intended to make full use of the potential of a multi-crew flight deck by introducing a check on the mental state of the colleague. Surprise affects individuals differently depending on the level of fatigue, different mental models, or previous experiences. This can create a 'split cockpit' where two individuals work in isolation instead of together. A complete 'Relax' takes five to ten seconds, surprisingly similar to the (aviation) saying, *"sometimes it is better to count to ten before taking action."*

Observe and Confirm

After managing surprise effects, a proper decision-making process can be initiated. Many current decision-making tools begin with observing the facts and communicating them. The aim was to use this step to start up the cognitive process in an easy way and to provide another barrier to rushed decision-making and/or action taking. No decisions are made – only observations have to be called out. Finally, the cognitively more demanding steps of confirming the situation and the regular decision-making process steps, such as risk assessment and option generation, are taken.

To summarise, the purpose of the strategy is fourfold:

- controlling physiological and emotional reactions
- being 'fail safe', i.e., not making things worse
- ensuring maximum team performance (preventing split cockpit), and
- connection with current (decision-making) practices.

Experiments

The experimental training had a setup of 1:30 hr classroom briefing time and 1:30 hr simulator time. It was designed to be an initial training which requires a follow-up recurrent training to secure transfer of training to the live environment.

In an introductory letter, the participating pilots were asked to think about a surprising event in their flying career, so this could be discussed during the briefing, but also to give practical relevance to the training. Specifically, time was spent on personal surprise effects, to be used as a future trigger to apply ROC. After some theoretical surprise background, the techniques described above were explained and practised by following instructions and in a visualisation exercise (also known as 'chair flying'). An important part of the classroom sessions was to normalise the emotional and physiological effect from surprise. These are very normal human reactions to an abnormal situation.

A total of 44 active airline pilots were trained in a simulator to practise the surprise recovery techniques – not aimed at one specific surprise, but at any surprise (technical, ATC, meteorological, crew- or self-induced, etc.). The message to the crews before going into the simulator was somewhat surprising to some of them: *"We are not going to surprise you."* (At least, not in the same way the real-life example did that crews provided in the classroom session.) Crews are trained very well to

expect surprises in the simulator. That and the fact there is no real danger, does not result in strong surprise effects. The only requirement given to the crews was to practise the ROC every time one of them thought it would be helpful in a real-life situation.

The first training result that can be measured is participant reactions, and in this case the participating pilots were very enthusiastic. They indicated the techniques helped them to control their emotions and they intended to use the techniques in real life situations. They also mentioned they felt better prepared for unexpected situations (and literature indicates that confidence helps to dampen the effects of surprise). The researchers observed that the pilots were able to learn and apply the techniques during this initial training. These observations confirmed that the techniques influenced their information gathering. Instead of rushing to conclusions, pilots who used the techniques verbalised the information cues (the 'observe' step) before analysing it (the 'confirm' step). For the research team, this was an indication that the techniques have a beneficial effect on the decision-making process.

Implementation

After these encouraging results, KLM chose to implement startle and surprise training by setting up a core team. A few changes were made to the experiment setup to connect seamlessly with the current procedures and training practices.

To summarise: an electronic briefing package (iBook) was sent to the pilots before receiving training, the briefing time was reduced to 1 hour, a 360 video for VR goggles was made to practise the techniques, and simulator time was extended to 1 hour and 50 minutes. The strategy was rephrased in a single word: 'Reset'.

The implementation started by training the new instructors by the core team. This was to 1) standardise and provide a deep understanding of the theory and the technique, and 2) to stimulate enthusiasm about the potential benefits of the training. There was concern about whether pilots would be open for the breathing technique and muscle relaxation, so well-informed and enthusiastic instructors were deemed a key success factor. The core team stressed the fact that these techniques were not becoming part of standard operating procedure, but a tool for every pilot, to be used at their own discretion.

After this thorough train the trainer process, all KLM pilots received their initial startle and surprise training, with a follow-up six months later, during regular simulator sessions. Like the experiment pilots, the feedback from the majority indicated they felt better prepared for unexpected situations. The pilot core turned out to have an open mind towards the training ideas, as the majority indicated that they were planning to use the 'Reset' to handle real-life surprises. Later on, in incident investigations, multiple crew testimonies were received indicating they used the 'Reset' when handling the situation and they believed it improved their performance.

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