ADAPTING TO THE UNEXPECTED IN THE COCKPIT

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2 SUMMARY OF THE PROPOSAL FOR PAPER

Modern aircraft in civil aviation operations use highly automated systems to ensure a high level of safety and reliability. The flight crew in an airline cockpit has the ultimate control of the systems and must be able to respond when they find themselves facing an unexpected situation. There is a concern that crew sometimes may not be able to identify the appropriate strategy to handle unanticipated events. We have put airline flight crews in a flight simulation environment and observed their behaviour in response to unexpected situations in a recent experiment as part of the Manual Operations for 4th Generation Airliners (Man4Gen) EU research project.

The experiment was designed to create an operationally relevant situation for line pilots that would include coping with unexpected events. The intention behind the experiment was to study the flight crew's decision making and risk assessment in response to a situation that they were unlikely to have encountered during routine training. The scenario was designed to include a number of events that included ambiguity, challenge, and the need to adapt to unexpected circumstances for which transitioning to manual control was required. The experiment was carried out with a total of 12 crews made up of operational line pilots, 24 pilots in total – both captains and first officers.

The analysis of their behaviour combined a cognitive systems engineering (Rankin, Woltjer, Field, & Woods, 2013) and sensemaking perspective (Klein, Phillips, Rall, & Peluso, 2007; Weick, Sutcliffe, & Obstfeld, 2005) with industry operational behavioural analysis methods. This paper applies an analysis method based on Hollnagel's Extended Control Model (ECOM) (Hollnagel & Woods, 2005) to examine the actions and decisions of the flight crew and identify the strategies that are applied when adapting to the situations and events in the simulator. The outcome of this analysis is combined with the operational results of flight instructor ratings of behaviour and performance related to the competencies that flight crew are expected to apply.

The ECOM analysis identifies the crew's actions in different layers of control (targeting, monitoring, regulating and tracking) to analyse crew strategies to adapt to unexpected events. The analysis aims to understand the performance of the crew-automation Joint Cognitive System (JCS) (Hollnagel & Woods, 2005) and what this means for the crew's ability to anticipate and respond to events effectively. The experiments investigate why crews make the decisions that they do, and the analysis aims to explain what these decisions and control layers are dependent on.

Implications for further research and future development of training and operational recommendations for flight crew in modern airliners are briefly discussed.

3 RELEVANCE FOR SYMPOSIUM

The application of the ECOM identifies and describes the variability in crew strategies adapting to unexpected situations to better understand the performance of flight crew on highly automated flight-decks. The cornerstones of resilience (Hollnagel, 2011) are discussed to explore strategies for adaptation, especially how anticipation of events and circumstances, devising and implementing responses, and monitoring environmental conditions and crew and automation behaviour are related in crews with varying instructor rating scores. The aim is to describe and explain the variability expressed by all crews, and to learn from the simulation's results in terms of training and instruction, and other operational recommendations such as crew collaboration and use of procedures.

4 SIGNIFICANCE/TAKEAWAY

ECOM is used to analyse the highly procedural environment of cockpit operations to identify the strategies and adaptability that are used by flight crew in response to unexpected situations. While highly reliable systems and procedures ensure safety in normal operations, adaptability and decisiveness are required in unexpected situations to handle the situation successfully. Through an analysis of the operational crews in a flight simulation experiment, coupled with the rating of flight instructors, the successful strategies can be identified.

5 REFERENCES

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