



## SUMMARY

### Project Context

Modern highly automated aircraft (4th Generation airliners) are extremely safe, and there is a particularly low chance of an accident when operating these aircraft. Automation clearly plays a very positive role in enhancing aviation safety and preventing accidents. However, there has recently been a steady rise in the number of accidents that are attributed to the ability of flight crew to assess and understand an unexpected situation, and consequently respond appropriately to handle the situation, and eventually in some cases limited manual handling skills by pilots.

The main objectives therefore of the project are twofold:

- To identify the factors in highly automated, 4<sup>th</sup> generation, aircraft that affect the ability of the flight crew and aircraft to handle unexpected events and gradually deteriorating conditions to maintain effective control of the aircraft.
- To subsequently identify methods to prepare flight crew to deal with unexpected events, using the training, procedures and systems available to operators of highly automated aircraft today.

The project will achieve these objectives using a phased approach. The initial phase of the project focuses on establishing the background of the problem from an academic and an operational perspective. This is then applied in an experimental setting to reproduce the challenges faced by flight crews in a way that their behaviour and responses can be studied. The results of the experiments form the basis for an initial concept development to improve the flight crew's ability to handle challenging situations, and subsequently focus on the development of aviation industry guidelines. The guidelines are applied and evaluated in an operational/experimental setting to validate their application.

### Progress so far

The progress in the project in the first period has been good. The project team identified a number of industry and academic studies that were applicable to the project's goals. These studies were analysed and used to determine the level of knowledge that was already available about the ability of flight crew to handle unexpected events in a 4<sup>th</sup> generation airliner.

The conclusions of this initial analysis were used to establish an experimental method that could be used to study crew responses from different academic perspectives: fMRI, Situational Awareness, Cognitive Systems Engineering. In addition an industry analysis method has been applied to use expert analysis of crew behaviour in an experimental setting. These methods have been applied to experiments carried out in flight simulators, as well as in an fMRI setting. Four sets of exploratory experiments have been carried out to study flight crew response to events and scenarios designed to cause an element of surprise and confusion in an operational setting. The results of these experiments are currently being analysed to determine the most applicable method of addressing the challenges faced by the crew in today's daily operations.

## Final Results

The expected results of the project are guidelines and recommendations for the aviation industry to improve the ability of flight crews to prevent unexpected situations developing into problems that they can't handle. The guidelines focus on the training of core competencies, improvement of procedures, and systems design to improve the resilience of the crew and aircraft. This improvement is designed to help recover from, and eventually eliminate, human error. The project's results will enable flight crew to handle different unexpected events and address key accident rates – such as Loss of Control in-flight, Go-Around safety, Runway excursions, and system component failure - and therefore improve the overall safety of the industry making an important contribution to reducing the accident rate by 80%.

In addition, the research undertaken in the project will improve our understanding of cognitive factors – such as situation awareness and sensemaking - in surprising and confusing situations, enabling us to better research these subjects in the future, as well as apply human factors knowledge in operational solutions.



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