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Identifying Mode Confusion in Recorded Aircraft Data

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ABSTRACT

In recent decades, commercial aviation accidents have occurred due to human-machine interaction (HMI) problems known as “mode confusion.” This is caused, in some cases, by a lack of understanding of onboard systems by pilots. Large amounts of Flight Operational Quality Assurance (FOQA) data are available, analysis of which could assist in identification of safety risks in daily operations. Through analysis of pilot reactions and recorded aircraft data, methods to detect mode confusion are developed to improve aviation safety. This study was conducted by inducing mode confusion into a flight simulation scenario and analyzing aircraft data to detect emerging patterns. Three distinct Instrument Landing System approaches were flown by participants unaware of experiment details. Differences between these approaches force the pilot to capture the glideslope from above using automation. The results indicate that pilots reacted to the mode confusion by providing control input which opposed the goal of the automation. This reaction was a response to the divergence between pilot intent and automation intent. Further experimentation is needed to determine a general, universally accepted data marker for the occurrence of mode confusion. Ultimately, this outcome will assist the aviation community in addressing drawbacks of modern automation.

KEYWORDS

Human-Machine Interaction (HMI), Flight Operational Quality Assurance (FOQA), mode confusion, glideslope (G/S), autopilot, Instrument Landing System