EVIDENCE-BASED METRICS TOOLKIT FOR MEASURING SAFETY AND EFFICIENCY IN HUMAN-AUTOMATION SYSTEMS

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BACKGROUND

Spaceflight missions rely on the application of automation systems in order to complete tasks (i.e., operation of a robotic arm) and maintain an operable and habitable environment (i.e., life support systems). With a high dependence on automation systems, multiple issues are relevant to consider in human-automation interaction. These interaction factors could lead to increased instances of error in the use of automation which, in turn, may lead to decrements in mission performance and crew member health [1]. To address the impact of automation failures for spaceflight crews, this effort seeks to directly optimize safety and efficiency for NASA space flight crews to determine the optimum level of performance at which using automation is still safe for crew.

The primary purpose of this project is to develop an evidence-based framework of guidelines for human-systems integration requirements. Additionally, a measurement toolkit will be developed to guide the systematic and valid observation of team processes and other key factors related to safety automation system interaction. This measurement toolkit will be applicable across multiple levels of automation (LOA) [2], and numbers of agents that are operating with the system (i.e., team size). We intend to develop applicable methods to observe individual and team level factors and constructs that can be used to detect deficiencies in the man-machine system. To accomplish these aims, we propose a 3-year effort that will consist of three overarching phases which leverage both qualitative and quantitative methods: (1) initial development of a human automation interaction metrics toolkit, (2) preparation for experimental studies, and (3) validation of the human automation interaction metrics toolkit.

The perceived impact of this effort will address the need for optimizing automation system use safety and efficiency by coupling human factors research in automation complacency with the science of metric development and measurement. This approach will expand the current knowledge of the elusive boundary between safety and efficiency, objectively determining where the cut-off criteria lies for ending an automated function and returning to manual control. The final product will allow NASA to establish requirements and/or standards for human-automation system performance.

REFERENCES