Utilizing the Systematic Literature Review in Aviation
--- A Case Study for Runway Incursions

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Abstract
This research presents the process for a systematic literature review examining factors that contribute to runway incursions (RIs). A systematic literature review uses other research results as data for systematic analysis. Runway safety is a top priority. In the US, there have been increasing and typically three RIs occur every day. This paper identified 134 studies related to medical and health. The methodology used in this study is a systematic literature review based on guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement. These guidelines were used to conduct a systematic literature review of correlating factors contributing to higher incidences of RIs.

Research Motivation and Scope
According to the FAA, 32 category A RIs and 43 category B RIs occurred in the five years between 2012 and 2016. During this time period, there were 500 more RIs classified as category C or category D. This is consistent with research conducted by Heinrich, which found that for every accident that causes a major injury, there were hundreds of incidents that cause minor injuries and 300 incidents that cause no injuries. Identifying and reducing RIs of all categories will help reduce the likelihood of severe RIs that may cause injury or death.

Critical Role of RIs in Aviation Safety
RIs are a critical concern for the safety of the air transportation system. In the worst case, a RI can result in a collision and loss of life.

Steady Rise of RIs in the U.S.
According to the statistics, the number of flights in the United States has decreased slightly since 2012; however, the number of RIs has continued to increase during the same time period.

Methodology
The systematic literature review methodology may be used to investigate other topics in aviation, as well as an expanded investigation of RIs. Expansion of the study to include agency reports could encompass the findings of the FAA Runway Safety Reports between 2008 and 2014, the FAA National Runway Safety Plan for 2015 to 2017, and The European Aviation Plan for the Prevention of Runway Incursions published by the Eurocontrol.

Comparison of Quantitative Research and Qualitative Research
Qualitative research typically identifies more contributing factors for RIs than quantitative research. The majority (if not all) of qualitative research studies identified at least four contributing factors for RIs, whereas only one (of 12) quantitative research studies identified four contributing factors. Quantitative research papers often focus on only one or two specific contributing factors. This may reflect challenges capturing some of the characteristics of correlated factors with statistical methods. All quantitative research studies were published after 2011, whereas most qualitative research studies were conducted before 2013.

Recommendations and Discussion
Recommendations for Runway Incursions
to address human factors is to conduct initial and continuous training for pilots, air traffic controllers and ground operators to mitigate all causes of RI, including PD, IO and VPD incursions. Human factors training may focus on both technical and non-technical skills.

Recommendations also address airport facilities, including airport geometry, airport characteristics, and airport technical factors. In some cases, RI can be addressed by reducing airfield complexity, including the number of intersections and conflict points.

Further Research
The systematic literature review methodology may be used to investigate other topics in aviation, as well as an expanded investigation of RIs. Expansion of the study to include agency reports could encompass the findings of the FAA Runway Safety Reports between 2008 and 2014, the FAA National Runway Safety Plan for 2015 to 2017, and The European Aviation Plan for the Prevention of Runway Incursions published by the Eurocontrol.

Conclusion
A reduction of RIs is a top priority for FAA and an important activity to ensure aviation safety. This study demonstrates the process for a systematic literature review an investigation of RIs using qualitative, mixed-method and qualitative approaches published in peer-reviewed journal and conference papers. Six contributing factors to RIs were identified: human factors; airport geometry, technical factors; airport characteristics, and organizational factors. This research demonstrates the value of this systematic approach to synthesis research findings from multiple studies, and advance research, increase safety, and optimize efficiency in the aviation sector.