A Collision Risk Assessment Method for Runway Threshold Management: A Case Study of Singapore Changi Airport

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Abstract— Airports are indispensable infrastructures in an air transportation system with runways being the most critical component serving departures and arrivals. With constant increase in demand of air traffic, much effort has been made to manage the runway capacity to improve the throughput of airports. Apart from operational changes, there is a significant investment in runway infrastructure improvements such as new runway development/extension. However, many runways suffer from long runway thresholds due to safety constraints in face of approach path obstacles, which leads to reduction in Landing Distance Available (LDA). This paper proposes a method to manage the runway threshold by computing and assessing the collision risk of a given flight approach path with an obstacle profile. To do so, we develop the arrival flight profile along with its altitude distribution using ADS-B data. We then factor in the height of obstacles with reference to the obstacle surface profile. The convolution of two distribution is then used to assess the collision risk between the aircraft on approach path and the obstacle for better management of runway threshold. The proposed model is applied at Singapore Changi Airport, which has a long runway threshold due to the ship movements in the Strait of Singapore, which are considered as safety risks to the landing aircraft. Results suggest that, for CAT I/II approaches, with aircraft having aerodrome reference code 3/4, the runway threshold for runway Singapore Changi Airport 20R can safely be reduced by approximately 100 meters, while meeting the safety requirements.