

Prevention of runway incursions in a data-link environment: empirically proven features for a next-generation airport moving map

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Abstract

Increasing airport traffic levels are leading to rising numbers of runway incursions (RIs), which pose a serious risk to aviation safety. Analysis of recent German RIs reveals problems stemming from lack of orientation, deviation from clearances and a low detection rate of active RIs. To counter these problems, novel features for the next generation airport moving map (AMM) were developed, including a traffic ground speed and heading indicator, visualisation of other traffic runway clearances, and indication of potential collision points during active RIs. The latter feature was tested in a comprehensive simulator study with 36 commercial airline pilots, with the aim of increasing the RI detection rate, increasing the number of correct manoeuvres and decreasing the RI response time. The results showed a slight increase in the RI detection rate, a significant increase in the number of correct manoeuvres and a nearly 70% reduction in response time with the new feature compared with the standard AMM.

Introduction

The collision of two Boeing 747s on the fog-bound runway of Tenerife North airport in 1977 resulting in the deaths of 583 passengers and crew remains to this day the aviation accident with the highest death toll in history (Hubert, 2010). Although mercifully rare, RI accidents tend to lead to large numbers of fatalities, with a recent survey of accidents involving turbine aircraft counting seven fatal RI accidents between 1995 and 2008 leading to a further 261 deaths (Flight Safety Foundation, 2009). Furthermore, dozens of near-misses occur each year. In fiscal year 2008 alone there were 12 RI incidents in which a collision was only narrowly avoided in US airports (FAA Air Traffic Organization, 2009). In Europe* there were 15 such incidents in 2008 (Eurocontrol, 2010). It is clear that runway incursions continue to pose a serious threat to safe aircraft operations.

But first, how is a runway incursion defined? Over the last years, aviation regulators worldwide have settled on the standard ICAO definition as *any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft* (ICAO, 2007). This standard definition, coupled with a well-defined severity

* Defined as the Eurocontrol Statistical Reference Area (Eurocontrol, 2010)