# Locating Faults On Energized Airfield Lighting Systems

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**On some airports, one airplane per minute lifts off or lands. This means that the surrounding operations have to run like clockwork. Any major disturbances will be detrimental to the traffic flow of the airfield.**

Did you know that air traffic is expected to double within the next 15 years? And in the meantime, airports are unable to expand due to lack of space. Therefore, in order to meet the demands of the future, airports have to streamline their operations. On the airfield, this translates into minimized downtime and maximized airfield-availability.

In order to maintain availability and safety during night time or in harsh weather conditions, the use of airfield lighting is of paramount importance to airfield movements. In the case of a critical lighting failure where two consecutive lights or more have failed, all traffic is suspended. There are a number of possible causes for critical lighting failures. One possibility is that two or more consecutive lights break at the same time, another is that a power distribution failure has occurred. The latter is significantly more likely.

In the case of a failure, a maintenance team is dispatched out on the airfield to locate the fault. To date, individual light faults can be automatically pinpointed but there is no way of performing automated fault location on the power distribution systems. Current methods are personnel intensive and time consuming, and by minimizing the time between fault occurrence and reparation, the availability can be significantly increased.

The purpose of this study is to evaluate if it is possible to implement an automated fault location device in existing airfield lighting systems, as well as evaluate possible methods of state of health (SoH) monitoring for the power distribution systems. A lot of inspiration is drawn from the electric power industry where automated fault location has been in use for decades with great success.

The results of the study reveal that fault location on airfield lighting circuits where the lights pose as electrical loads is a complex task. The lights along the power cable act as obstacles for the fault signals that are utilized in some methods. However, one fault location algorithm utilizing circuit parameters to reconstruct the electrical dynamics along the length of the power cable shows promise.

The SoH of a cable system is of interest in regard to preventive maintenance. One can estimate the operative age of a cable by measuring its capability to transmit current. In theory, this could allow the maintenance team to possibly foresee electrical breakdowns, and thus plan cable replacements and maintenance before the fault occurs. A major issue with SoH is the weather and water dependency of airfield cable systems. A SoH measurement only reflects the current state of the cable. On a sunny day, where no moisture has intruded the cables the benchmark might look good. However, as soon as water intrudes into splices and connectors, the original measurement will not be representative for the electrical quality of the system.

An automated fault location and SoH technology would not only minimize the time between failure and reparation in a critical fault situation, but also help the maintenance team by facilitating preventive maintenance planning.

The study has laid the foundation for future research and development within the area. The problem of airfield lighting fault location is still unsolved in the industry, and is more complex than initially anticipated. Automated fault location and state of health is a stepping stone to increased availability and minimized downtime of airfield operations, which is an integral part of the vision of the future airport.

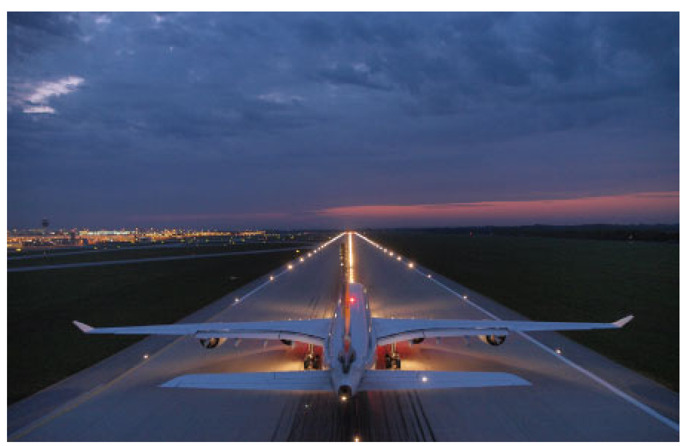

Fig. 1. An airplane ready for lift off at dusk.