New database could make airport ground movements quicker, greener and cheaper

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A new system for calculating the quickest and most fuel efficient routes for moving aircraft on the ground could transform the way our airports operate, according to new research.

Growth in air traffic and passenger numbers has led to warnings that European airports could become bottlenecks in the global air transportation system. As many airports are operating at or near to maximum capacity, industry experts recognise that infrastructure must be improved. Ensuring efficient movement of aircraft on the ground is a key way for airport stakeholders to save time, reduce costs and improve carbon emissions.

Aviation engineering specialists from the University of Lincoln, UK,

have now proposed an innovative system for airport ground movement to generate the most efficient routes and optimal speed instructions – or speed profiles - for pilots to follow during 'taxiing'.

The new system, built on a database of pre-computed routes, would be much faster than the current approach. Unlike the existing system, which is technically complex and demanding on computing power, it could also be used in real-time, reacting to sudden changes on the runway.

The research by Dr Michal Weiszer, Research Fellow in the School of Engineering at the University of Lincoln, could help to cut waiting times for passengers and support more efficient and environmentally friendly operations by reducing fuel consumption and carbon emissions.

The proposed database stores 'building blocks' from which any route on the airport taxi-way can be recreated. Each building block represents a small section of airport ground, for which the optimal speed instructions have already been calculated. A new algorithm can quickly combine these building blocks to produce the most suitable route for guiding aircraft from one location to another.

Dr Weiszer explained: "The ultimate aim of our research is to produce a more realistic, cost effective and greener ground movement. It is only very recently that studies have begun to take into account the issue of speed profile optimisation so that not only time efficiency but also fuel savings and a decrease in airport emissions can be achieved at the same time.

"The current approach to generating speed profiles is computationally demanding and cannot be used in real time, so in order to improve this system we are proposing a database of pre-computed solutions. Using this database in conjunction with our suggested algorithm would also avoid duplication of taxiway segments during planning, as it respects the

routes and schedules of other aircraft while preventing conflicts between them. This would be another major benefit for airport stakeholders.

"Our experimental results are based on existing data from Zürich airport, which is one of Europe's major air traffic hubs, and they show that our proposed approach would be very effective in speeding up the route-making process."

Dr Weiszer's new research, published today (29th July 2015) in the academic journal *Transportation Research*, builds on his previous studies proposing a new ground movement model for taxiing aircraft , based on 4-Dimensional Trajectory (4DT) optimisation (the integration of time into the 3D aircraft trajectory).

His proposed database and algorithm would make this model fully functional for existing airport management systems.

It paves the way for even more powerful and realistic models to be considered in the future, taking into account factors such as speed changes and passenger comfort, without adding significantly to planning time.

Provided by University of Lincoln