

**Project Title: The Impacts of Heterogeneous Maintenance Actions on Aircraft Routing Problems in regard to Airline Operations Reliability and Profitability**

研究項目: 研究飛機維修項目多樣化對航空公司營運可靠性與盈利的影響

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**Abstract**

Maintaining smooth airline operation is critical in the airline industry. In 2015, disruption costs due to flight delays amounted to about US\$25 billion worldwide and the average delay was about 47 minutes, as reported by Frankfurt-based consulting. In 2017, only in July, the numbers of flight delays already reached 226842, 191956, and 198221 in Asia, Europe, and the U.S respectively. Flight delays are usually caused by various circumstances that are beyond the control of airlines, such as severe weather conditions. However, as reported about 25% of flight delays are in fact due to maintenance issues, which can be improved by better optimization of aircraft routing problems (ARP).

Most of the existing papers assume all aircraft require a fixed and identical maintenance time and with the same maximum number of flying hours. However, nowadays, many airlines (e.g. Cathay Pacific, Hong Kong Airlines) are implementing a new maintenance practice that breaks down the 'A' check into many small packages. Therefore, some of which can even be conducted between two connected flights to maximize aircraft utilization, and this practice dramatically increases ARP complexity. Moreover, maintenance risk associated with different maintenance actions will also be considered. Maintenance risk in practice depends on the maintenance action and the age of the aircraft. It may induce different levels of risk in flight delays and cause disruptions.

The objective of the proposal is to propose (i) a new Cascade Neural Network approach to estimate the maintenance time required for and analyze the maintenance risk associated with each package using historical maintenance data, and (ii) a new column generation based methodology that incorporates the time and risk of heterogeneous maintenance actions so that the advantages of this new airline maintenance practice can be maximized.

