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Optimizing the process of airline fleet re-assignment to minimize the impact of disruptions

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Aircraft assignments often deviate from the original schedule due to technical failures, operational requirements and other unforeseen circumstances which can be termed as disruptions. In such situations, it is necessary for the airline to assign an aircraft on ground to replace the grounded aircraft. Such reassignments entail re-work of the network, seat configurations, fuel requirements, load and other operational requirements. An efficient method to carry out re-assignments is absent in the Sri Lankan context; although research has been conducted to identify the optimum methodology for fleet assignment, those related to disruption management and aircraft re-assignment to minimize the impact of disruptions are scarce; disruptions still cost about 10% of airline revenue according to research conducted. Through the background study on Sri Lankan Airlines and literature, it was identified that the constraints of existing models do not capture all the elements such as passengers, aircraft and crew in the optimization of their objective functions. Available models do not consider re-assignment options such as ferrying, swapping, delaying and cancelling, in their entirety either. The exploratory study established the fact that disruption recovery is a time consuming and complex task which is required to be planned and executed in a matter of minutes. The controllers are often constrained to produce only a single feasible plan of action which may not be optimal. It is a difficult task to evaluate the quality of the recovery action which is to be executed. In most airlines, the personnel generating the recovery plan do not have adequate software-based decision support to construct high-quality recovery options, to compare available options or assess the down-stream impact of a disruption. The research is aimed at developing a model based on heuristics and meta-heuristics for supporting a model for the formal optimization of disruption recovery decisions. The impact of disruptions on the airline, types of fleet, nature of assignments, past assignments and requirements of an assignment are taken into consideration as qualitative data analysis. Quantitative data analysis is used to assess alternative assignments that could have been possible, comparison of options, model building and impact analysis in terms of cost and frequency. The study identified and validated the heuristics/meta-heuristics involved in the current methodology followed in aircraft schedule recovery and the rational/logic behind current process that can support optimization model building using heuristics, integer programming and simulation.

Keywords: Airline disruptions, Fleet reassignment, Operations optimization, Operations research.