

Air Freight Forwarder's Short-Term Allocation Problem Among Heterogeneous Flights

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Abstract. A freight forwarder, one of the most important players in the air-cargo service chain, collects individual packages from shippers and transports the consolidated shipments to air-cargo carriers, some of which have signed the long-term block space agreements (BSA) with the forwarder. Although the BSA imposes a minimum charge on the BSA space, often referred to as the allotment, it allows the forwarder to achieve lower freight rates and to guarantee some space on direct flights. Air-cargo shipments are time sensitive; thus, an indirect flight's long transit time is undesirable. If on any day, the total demand from the consolidated shipments exceeds the allotment, the forwarder may purchase additional space from non-BSA carriers at higher rates, or indirect flights with longer transit times have to be used. On the other hand, if the total demand is less than the allotment, the forwarder needs to pay at least the minimum charge. We develop a mixed-integer linear programming model to allocate the daily shipments among BSA and non-BSA carriers in order to minimize the total cost, which includes both the freight cost based on the total chargeable weight and the penalty cost associated with the total transit time of indirect flights. Our model can be applied to all scenarios, regardless whether or not the total demand exceeds the allotment. In the case study of one of the largest forwarders in Thailand, we apply our model to the short-term allocation problem daily from April 2020 to July 2021 and find that the freight cost from using the proposed allocation scheme was 1% to 6% lower than that from using the current scheme.

Keywords: Air-cargo service chain, allocation problem, linear programming model