

Karlsruhe Institute of Technology

Institut für Operations Research Lehrstuhl Prof. Dr. K.-H. Waldmann

Air Cargo Revenue Management

Combined Allotment and Spot Market Allocation Model

Diplomarbeit von Dipl.-Wi.-Ing. Bettina Walz

Betreuer: Dipl.-Wi.-Ing. Rainer Hoffmann und Dipl.-Kfm. Christopher Schmacke

Problem Definition

The air cargo industry is often referred to as a prime candidate for applying revenue management techniques. Nevertheless, air cargo revenue management is still underdeveloped compared to the prevailing systems in the air passenger industry. This is due to a relatively high complexity driven by, for instance, multidimensional capacity (volume, weight), uncertainty of available capacity, and a short booking period.

In this thesis we propose a model which integrates two decision problems of cargo revenue management: the spot market allocation problem and the allotment management task. The innovative idea of this integrated approach is that it determines a holistic solution for both planning steps which are traditionally solved in a sequential process.

Air Cargo Revenue Management

In the first stage of air cargo revenue management, routing selection, a shipment is assigned to a flight leg at a particular time. After the aircraft's capacity has been assigned (allotment management & spot market allocation), a degree of overbooking is determined, and a decision on which shipments will be unloaded in case of an oversold situation is made.



The Decision Model



The first stage is the allotment phase. An allotment is defined as a long-term agreement between a customer and a cargo airline.

Task: Determine the optimalamount of allotment capacityand decide which customersget the granted space

The second stage is the spot market phase. The remaining capacity is sold on the spot market. Usually the spot market rates exceed the allotment rates such that an airline can generate more revenue on the spot market.

Task: Decide dynamically which capacity requests the airline should accept on the spot market

Combining Allotment Management and Spot Market Allocation

Allotment Market

Linear Programming:

Maximize revenue on the allotment market plus revenue on the spot market (which depends on the remaining capacity determined by the allotment decision) subject to the aircraft's weight and volume capacity

Spot Market

Dynamic Programming: Decide in each period whether it is more profitable to accept the requested shipment and to collect its revenue or to reject the shipment and reserve the capacity for a possible later request. Consider the

allotment	
possibilities by	
calculating all	
combinations to	
accept the	
requests on the	
allotment market	
(from rejecting all	
of them to	
accepting all)	

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combinatio	on as
input, the	spot
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provides c	ptima
spot mark	et
decisions	

Results

An example case tested the performance of the model by using a Middle East airline's data. The model generated a revenue increase of 29.64% to 243.13% compared to a first-come, first-served policy on four adequate routes. The combined optimization is particularly adapted for the air cargo industry since both optimization problems depend on each other. Therefore, an integrated optimization assures a maximum overall revenue improvement. As expected, it is noticeable that the model generates the highest revenue increase on routes with sparse capacity compared to a high amount of booking requests



probability of a	a snipment request and
the probability	of the shipment's size
and revenue.	

Boundary Condition: The airline can accept just as much requests as capacity available and just until the aircraft takes off

Α	4845 kg	12.64 m ³	72	\$ 2,693	\$ 9,241	243.13 %	
В	555 kg	3.17 m ³	4	\$ 375	\$ 700	86.56 %	
С	11,935 kg	31.05 m ³	12	\$ 11,153	\$ 14,459	29.64 %	

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