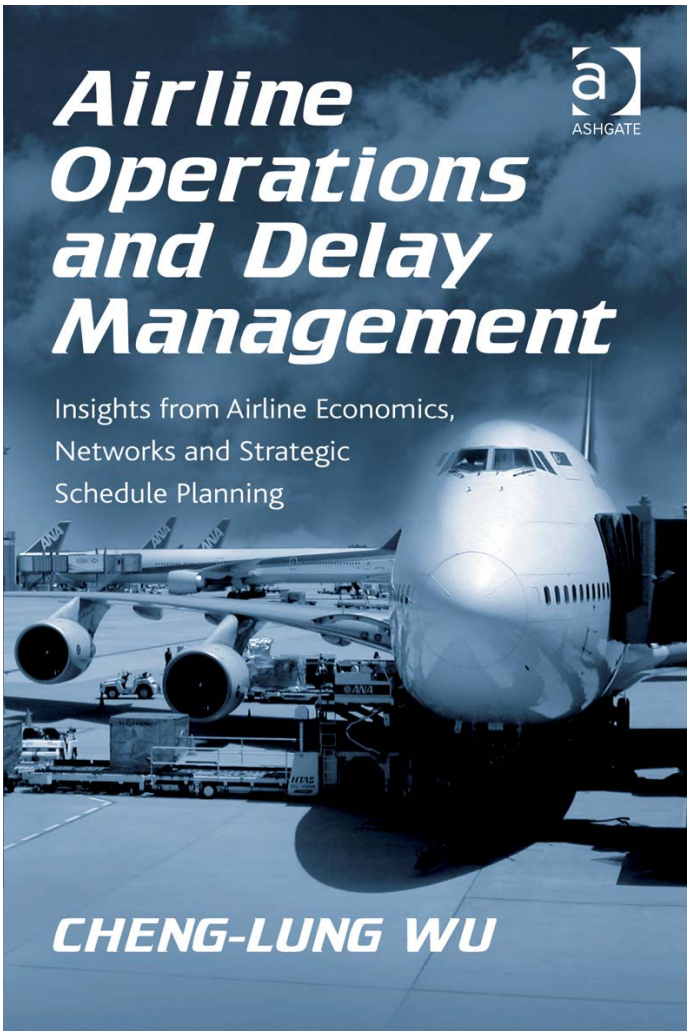
Airline Operations and Delay Management

Insights from Airline Economics, Networks and Strategic Schedule Planning

by Cheng-Lung Wu

Think about the February 2007 snowstorm that hit New York and about its catastrophic effects on JetBlue's network that left 130,000 passengers stranded. Similarly, the severe January 1999 snowstorm that hit Detroit leaving more than 8,000 Northwest Airlines passengers stranded in planes on the runway. These incidents brought about changes in airline regulation in the US and many lawsuits for the airlines. While these were weather-related incidents, it did lead to airline and network planners pondering whether there was something inherently wrong in the way the networks were designed, and whether the design itself could have contributed to a situation that led to the severity of disruptions.



Book Review by Gaurav Agarwal

Airline Operations and Delay Management tries to answer this question. In the recent past, a lot of work has gone into the area of network planning, scheduling and economics. However, this book addresses the subject from a wider range of perspectives, establishing a relationship between the commercial aspects of schedule planning and operational issues that they may cause.

Chapter 1 sets the tone by introducing the reader to airline networks, the driving forces behind airline economics, the schedule planning stages and airline operating environment. This is followed by a very detailed analysis of airline operations in Chapter 2, and then by Chapter 3 focusing on airport constraints that impact airline scheduling and aircraft turnaround processes that affect network punctuality. Similarly, Chapter 4 takes the reader further into network effects, and how a delay can propagate into the system. Chapter 5 discusses disruption management, and introduces the reader to the concept of inherent delays.

In my opinion, the meat of the book is in chapter 6, which describes the concept of robust airline scheduling. The author goes on to explain the advances in mathematical computing and operations research (OR) resulting in airlines producing a network schedule that is too highly optimized, has the lowest costs, and is compact with a high degree of synchronization that looks great in theory, but one that fails to take into account the uncertainties of real-time operations that may have stochastic delays and that are totally unpredictable. For instance, weather-related delays cannot be predicted. The result is that airlines end up spending far more costly resources in recovering the schedule if it falls out of synchronization.

The author explains common airline strategies and tactics to address these problems such as building buffer times into schedules to break any delay propagation into the whole network. Other tactical measures described are designing aircraft swaps in aircraft routings, designing short cycles, sticking to station purity and having move-up crews resulting in simplified crew assignments and implications for lowering costs such as storage of spare parts. Various integrated models are described to improve solution results. Finally, the author ends the chapter with describing a future philosophy of schedule planning and designing a network that not only addresses the profitability and core businesses, but also includes planning for robustness and operational flexibility. In my view, the book will benefit airline personnel directly involved in schedule planning and operations by making a cross-functional view available to them leading to much greater understanding.

About the author

Dr Cheng-Lung Wu is senior lecturer at the University of New South Wales in Sydney. He completed his PhD at Loughborough University (UK) in 2001 and specialized in airline operations, airline network modeling, punctuality management and schedule planning/optimization.

About the Reviewer

Gaurav Agarwal currently works as a Network Planner for South African Airways long haul International network. His past assignments include working with Northwest Airlines, South East Asian Airlines, Air Deccan and Bangalore International Airport.

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