

Identifying New Research Opportunities to Address Significant Changes Impacting the Passenger Airline Industry

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The passenger airline industry has greatly benefited from, and continues to benefit from, the contributions of the operations research community. The evolution of the industry, however, has resulted in the need to re-evaluate research priorities and – perhaps more importantly – to identify new problems that the OR community has not yet recognized. The terrorist attacks of September 11, 2001 and the rising cost of fuel have altered passengers' approach to air travel. Furthermore, there has been substantial growth in the market by “niche carriers” who compete in limited markets against the major hub-and-spoke carriers. Another sizable change is the increased use of regional jets, with lower fixed and operating costs and smaller capacities. All of these changes impact the applicability of existing OR research and raise new questions to be addressed.

I propose to conduct an in-depth study of the passenger airline industry to identify critical new research questions, particularly in the areas of scheduling and operations.

My initial work in the area of transportation and logistics began with the freight transportation industry. I spent five years after my undergraduate degree working at a small software company that developed decision support tools for trucking companies. Given the size of the company (about 13 people when I first joined), my responsibilities ranged from sales to product design to customer training, giving me access to individuals throughout the organization. This was a tremendous learning experience, particularly in understanding the gap between theoretical (academic) ideas and their implementation in real-world environments.

When I began my PhD program, my focus shifted from freight to passenger transportation, particularly to airline planning. The main contribution of my dissertation was the development of new modeling and solution techniques to integrate the airline crew scheduling and aircraft routing problems so as to develop schedules that more efficiently utilize crews, which are an extremely costly resource (the second highest operating expense of the airlines, after fuel). I am currently working on a number of large-scale optimization problems in transportation and logistics, including a project integrating the airline crew scheduling and fleet assignment problems, in which pilots and aircraft types are assigned to flights.

The field of operations research as a whole has made tremendous contributions to the airline industry, particularly in the areas of schedule planning and revenue management. The high cost of most airline resources (aircraft, fuel, pilots, etc.) and the existing technology infrastructure has led the airline industry to be very receptive to OR techniques, and the complexity of the system is well-suited to OR tools. In return, the OR community has developed many new techniques for solving these complex problems and has been actively involved in seeing their implementation through to fruition. Many of these new ideas have also led to more general advances that have been applied in a broad set of industries and application areas.

In the future, the OR community can continue to provide such invaluable help – but only if we develop a better understanding of the industry's new challenges, rather than continuing to focus on improving solution techniques for older, more familiar problems. There is the risk that many of the opportunities for researchers to contribute to the airline industry will be missed, not for lack of innovative ideas or the technical skills needed to solve difficult problems, but instead due to a lack of awareness of the most critical problems.

The primary objective of my industry study over the next two years will thus be to **identify** critical outstanding problems in passenger airline scheduling and operations and to **disseminate** these problems to the research community. Because of the vast scope of the problem domain, I will focus my efforts on three critical topics — integrated planning, robust planning, and real-time recovery.

I envision three primary components to my industry study. The first and most critical is the use of extensive on-site visits and meetings with representatives from a range of airlines (major hub-and-spoke carriers, niche players, etc.) and, in particular, with individuals from a range of positions (not just members of internal research groups, but from a cross section of the organization), in order to get multiple perspectives on the perceived areas of opportunity. I hope to develop both a broad view of the industry and also to develop a deeper relationship with one traditional hub-and-spoke carriers as well as one recent entry into the niche market. I will also continue to participate actively in the associated research community, including NEXTOR, the INFORMS Aviation Section, and the Global Air Alliance at MIT. Finally, I will build a coalition of junior researchers and graduate students to help gather information and insights about important new research topics, related research in other fields and application areas, and communal sources of data for initial prototyping and testing of new ideas. My affiliation with the Sloan Industry Studies Program and, in particular, my participation in the Early Career Development Committee has already begun to provide me with the framework for this coalition and I look forward to extending it in the next two years.