New scheduling tool offers both better flight choices and increased airline profits

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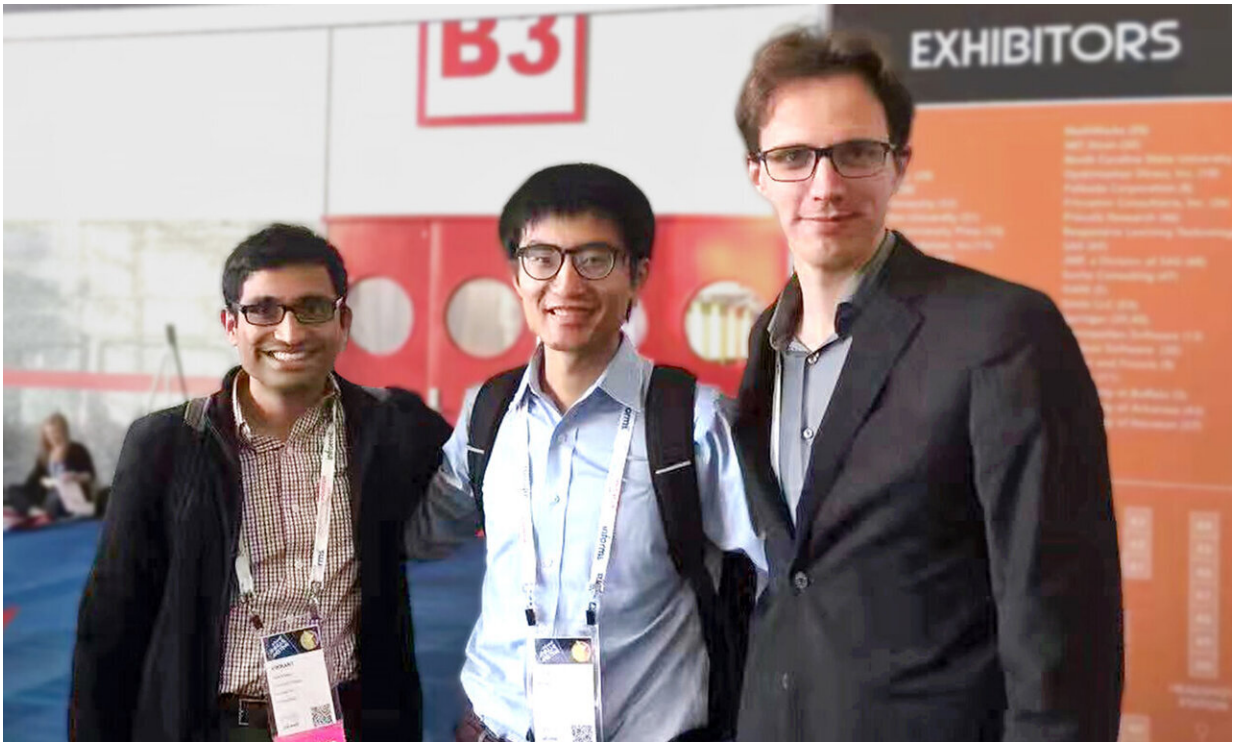

From left, Vikrant Vaze, assistant professor of engineering at Dartmouth; Keji Wei, an engineering Ph.D. candidate while working on the paper and now a senior operations research analyst at Sabre Corporation; and Alexandre Jacquillat, an assistant professor of operations research and statistics at the MIT Sloan School of Management. Credit: Thayer School of Engineering at Dartmouth

Researchers from Dartmouth and the Massachusetts Institute of Technology (MIT) have developed an original approach to flight scheduling that, if implemented, could result in a significant increase in profits for airlines and more flights that align with passengers' preferences. The approach is presented in a paper, "Airline Timetable Development and Fleet Assignment Incorporating Passenger Choice," recently published in *Transportation Science*, the leading journal in the field of transportation analysis.

Some of the most critical decision-making steps taken by airlines across the world rely on tools that do not fully incorporate passengers' preferences and the dynamics of flight scheduling, resulting in missed profits and unsatisfied passengers, according to the authors. The new paper uses 2016 data from Alaska Airlines to introduce an original integrated optimization approach to comprehensive flight timetabling and fleet assignment while taking into consideration passengers' preferences, such as flight departure time.

"Beyond ticket prices, perhaps the biggest thing that air passengers care about is the convenience of flight schedule. Yet, due to the associated computational complexities, nobody has really tried to completely redesign an airline's flight schedule from scratch to take passenger preference into account," said co-author Vikrant Vaze, assistant professor of engineering at Dartmouth. "This paper does just that, by proposing a comprehensive mathematical model and a new algorithm to solve it. It aligns the flight schedules to passenger preferences, in turn maximizing airline profits."

The model's flexible and comprehensive approach would enable airlines to increase the number of passengers with one-stop itineraries, and, consequently, dramatically increase the total one-stop revenue and the total operating profit compared with the most advanced approaches currently used in the industry. In addition, the paper suggests that an

airline using this approach would experience a significant increase in market share.

First author Keji Wei, who was an engineering Ph.D. candidate at Dartmouth while working on the study, received the Anna Valicek Award at the Airline Group of the International Federation of Operational Research Societies (AGIFORS) Symposium last fall for his work on this paper. Wei is now a senior operations research analyst at Sabre Corporation, a leading technology solutions provider to the travel industry.

In addition to Wei and Vaze, the paper was co-authored by Alexandre Jacquillat, an assistant professor of operations research and statistics at the MIT Sloan School of Management.

The authors note that the paper doesn't consider factors such as business strategy and aircraft orders because the data is not available, as well as airport gate and slot availability for simplicity's sake. However, the approach is designed to be versatile and usable for a variety of strategic planning decisions made by major airlines with a realistic computational budget.

Vaze is currently working on a follow-up paper that will incorporate revenue management considerations into scheduling and fleet assignment.

More information: Keji Wei et al, Airline Timetable Development and Fleet Assignment Incorporating Passenger Choice, *Transportation Science* (2019). DOI: 10.1287/trsc.2019.0924

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