Choice-Driven Service Network Design for Regional Air Mobility

[1]*Yuhan Jiang, [2]Xiaohan Zhou, [1]Guglielmo Lulli, [2]Shaopeng Zhong, [1]Yu Jiang.
*lead presenter
[1]y.jiang24@lancaster.ac.uk, Department of Management Science, Lancaster University, Lancaster, United Kingdom
[2]Department of Transportation and Logistics, Dalian University of Technology, Dalian, China

With the development of Advanced Air Mobility (AAM), it provides a novel and competitive alternative for regional travel. This study focuses on the AAM Service Network Design (AAM-SND) problem, aiming to optimise vertiport locations, service frequency and pricing strategies while capturing the interdependencies between passenger travel choices and network expansion to maximise overall profitability over a multiple-period time horizon. To overcome the computational challenges of integrating a choice model into AAM-SND, we propose an exact solution approach that substantially outperforms traditional linearisation approaches in terms of computational efficiency and solution quality. We employ the proposed AAM-SND model to explore two distinct investment paradigms- namely, a centralised investment and a decentralised investment network- to provide a foundation for broader application. The experiments are constructed based on the existing UK railway network, which contains 30 cities. Results reveal a strong interdependence between vertiport and electric vertical takeoff and landing aircraft investments. Moreover, in terms of network outcomes, AAM's advantage is most evident in city pairs that require significantly longer travel times by ground transportation. Lastly, passengers exhibit high sensitivity to pricing strategies, as variations in utility coefficients lead to different network structures and impact overall profit performance.