**Tentative title**: Integrated UAV Recovery under consideration of service level guarantees

**Abstract**: Throughout the recent decade, various research studies have proposed to leverage the concept of urban air mobility for an effective construction of a package delivery service. The major underlying idea is to lift the typically ground-based delivery service to the third dimension, while addressing problems such as last-mile delivery and recurrent traffic jams in major metropolitan regions around the world. Such delivery services, however, are prone to the presence of disruptions, in which parts of the service network are affected, e.g., due to UAV physical failure, UAV network delay, or vertiport closures. In this study, we develop a model for UAV recovery under disruptions, under the consideration of service guarantees, where sender / receiver may buy service levels with distinct levels of penalties and delivery windows guarantees. To the best of our knowledge, this is the first study to propose a sophisticated package delivery realization problem under realistic penalties. The modeling and optimization of the service in presence of disruptions and realistic service failure penalties, is inherently challenging since it leads to a non-linear formulation. Our computation experiments show that the model can be solved in acceptable computation times for medium-sized instances based on real-world data. Our results indicate the benefits of considering service level guarantees and the induced package materialization under several realistic disruption scenarios, and, thus, contributes towards the existing literature on UAV delivery under service disruptions.

**Disruption types**: UAV delay (aircraft delay), UAV physical failure (aircraft on ground), vertiport/hub closure (airport closure) ... add another “new” one, maybe massive package recall of all packages from a specific origin?

**Fare classes**: What is the equivalent in UAV delivery? Usually, one would pay higher prices for either faster delivery of packages or as a fee for a lower risk to be disrupted. The latter could lead to an interesting story of buying service guarantees in UAV delivery. Alternatively, there could be some very cheap “no refunds” class?

**Phantom package data**: Are there any rules in China for one of the delivery services concerning complicated/non-linear penalties? If not, how to create sensible data?

**Maintenance**: The major question seems how to argue for the necessity of maintenance? What alternative regular event could be modeled in case of UAVs? Maybe something related to battery checks/recharging?

**Crew**: Needs to be eliminated, since dealing with UAVs. What could be added instead? Without crew, does the model become very similar to another model in the literature? In addition, if crew is removed, is it significantly easier to develop fast heuristics?