

Level of Service Concept for Vertidrome Operations to ensure connectivity for multimodal transportation

Agency Research Team (ART) workshop on passenger-centred mobility
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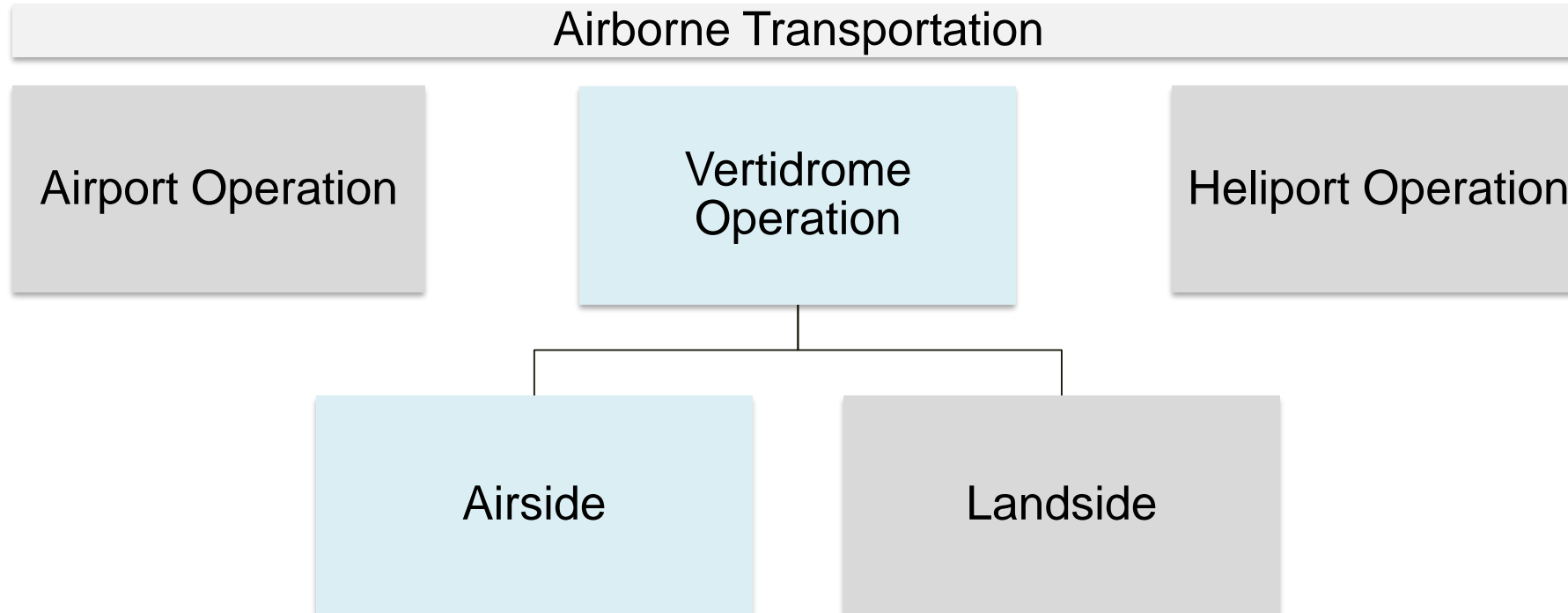


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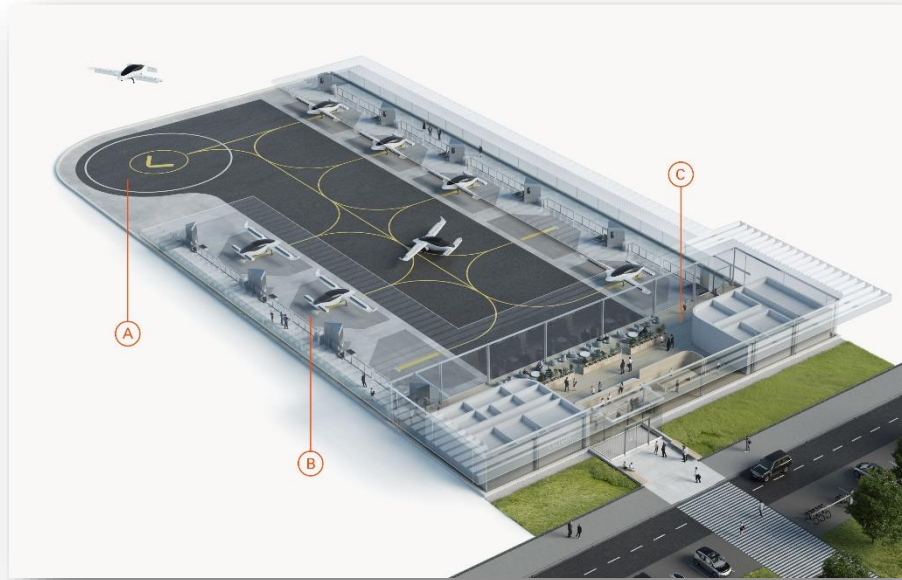
Knowledge for Tomorrow



UAM Vertidrome Operations

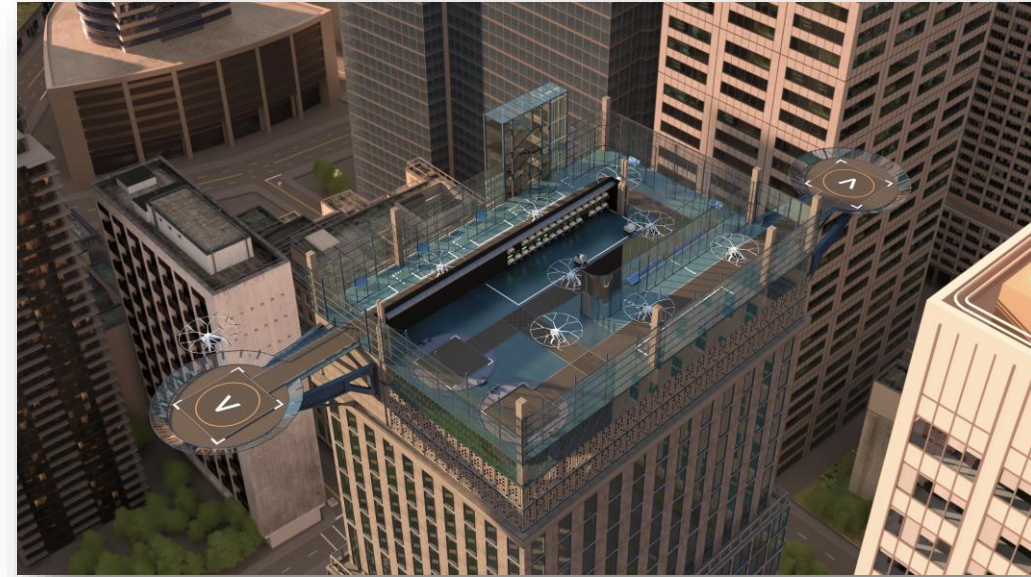


UAM Vertidrome Operations: Examples



Exemplary Vertiport by Lilium

[1] Lilium GmbH, "Designing a scalable vertiport," *Lilium*.
<https://lilium.com/newsroom-detail/designing-a-scalable-vertiport> (accessed Jun. 11, 2021).



Air Taxi Infrastructure by Volocopter

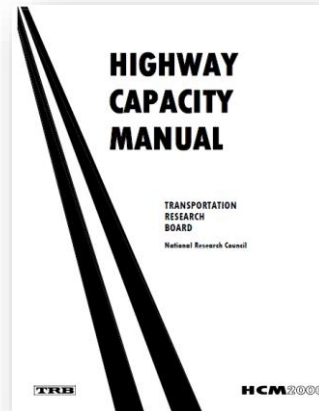
[2] Volocopter GmbH, *2018_04_05_Volo_Hub_Overview_without_roof.jpg* (4960x2790).
2018. Accessed: Jun. 11, 2021. [Online]. Available:
https://press.volocopter.com/images/mediainages/2018_04_05_Volo_Hub_Overview_without_roof.jpg



UAM Vertidrome Operations

How do we decide if a vertidrome satisfies our requirements from an operational perspective?

Level of Service
Concept



[3] Transportation Research Board, Highway Capacity Manual 2000. Washington, D.C.: Transportation Research Board, National Research Council, 2000.



[4] International Air Transport Association, *Airport Development Reference Manual*, 9th ed. Montreal: International Air Transport Association, 2004.



Vertidrome Airside Level of Service Concept

Development of a performance assessment method: Who, What, How?

		Reference	Stakeholder Requirements			
			Passenger	VTOL Vehicle	Vertidrome	
VALoS	Acceptable	Flow [Processed Operations/ Time Interval]	$\emptyset d_{PAX}$	$t_{AFT} - t_{NFT}$	$\geq 95 \% \text{ Flights} \leq d_{TF}$	Metric
			$\leq 2 \text{ Minutes}$	$\leq 5 \text{ Minutes}$	$d_{TF} = 2.5 \text{ Minutes}$	Objective
	Non-Acceptable		$\emptyset d_{PAX}$	$t_{AFT} - t_{NFT}$	$< 95 \% \text{ Flights} \leq d_{TF}$	Metric
			$> 2 \text{ Minutes}$	$> 5 \text{ Minutes}$	$d_{TF} = 2.5 \text{ Minutes}$	Objective

Nomenclature

d=delay
t = time (duration)

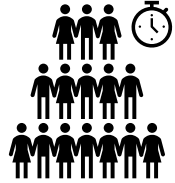
AFT = actual flight time
NFT = nominal flight time
TF = total flight
PAX= passenger

[5] K. Schweiger, F. Knabe, and B. Korn, "Urban Air Mobility: Vertidrome Airside Level of Service Concept," to be presented at the 2021 AIAA Aviation Forum, Virtual Event, Aug. 2021.



Vertidrome Airside Level of Service Concept

Example: Munich Trade Fair



Demand Distribution [1]

[6] K. O. Ploetner et al., "Long-term application potential of urban air mobility complementing public transport: an upper Bavaria example," CEAS Aeronautical Journal, Aug. 2020, doi: 10.1007/s13272-020-00468-5.



Vertidrome Layout
and Operational
Concept [2]

[7] K. Schweiger, F. Knabe, and B. Korn, "UAM Vertidrome Airside Operation: What needs to be considered?," presented at the Delft International Conference on Urban Air-Mobility (DICUAM), Virtual Conference, Mar. 2021.



Discrete Event Based
Simulation



Conclusion

- **VALoS**: indicator how well the processed operation has met the performance requirements
- **VALoS framework**: Analytical approach, based on a set of stakeholders which is expandable/ adjustable/ refinable with respect to the investigated use case
- Better understanding of a vertidrome's operation and its interactions and dependencies
- Future Work: Incorporation of arrival and departure procedures, weather dependencies, change of layouts, additional stakeholders etc.
 - HorizonUAM Symposium (<https://dlr.expert/horizonuam2021>)



Thank you for your attention!

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