Requirements for a modular vertiport design for project VERTIFIED

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An interdisciplinary project at the German Aerospace Center (DLR) titled Vertiport Research Infrastructure for Innovation Exploration and Demonstration (VERTIFIED) deals with building a vertiport concept, realizing and validating it at the National Experimental Test Center for Unmanned Aircraft Systems located in Cochstedt. Within the project, two vertiport locations will be considered: one at the airport and one in the urban area. One important aspect of the said work is to develop requirements for flexible, modular vertiport research infrastructure to plug and play with various vertiport configurations for its physical realization. This abstract encapsulates these requirements for building a 1:5 scaled vertiport for a small Unmanned Aircraft System (UAS) with a 2-meter wingspan (tip to tip). It has the characteristics of a Vertical Takeoff and Landing (VTOL) vehicle.

The regulations to be followed to build this vertiport are the European Union Aviation Safety Agency (EASA) regulations, specifically the EASA Special Condition SC-VTOL-01 [1] and the prototype technical specifications for the design of vertiports document [2]. These regulations are developed with the objective of defining dimensions, characteristics, applicability and location for the design of the vertiports where the Visual Flight Rules (VFR) are applicable. Furthermore, these vertiports will also utilize U3/U4 services provided by U-space, which are defined in EU Implementing Regulations 2021/664 [3], 2021/665, and 2021/666. With these regulations in place, the requirements for a modular vertiport that involves various components are described.

The focus of having a modular vertiport stems from having a cost-effective, stable infrastructure that is scalable in the future to hold an eVTOL for cargo delivery and passenger delivery use cases. A model city is also aimed to develop as a part of the experimentation that replicates an urban environment. Within this environment, a modular Final-Approach and Takeoff area (FATO), where the UAS takes off and lands from, will be installed on a wooden structure on a scaled building made from steel maritime containers. These containers also offer modularity when rearranging the urban area. The FATO markings will be painted on, and several omnidirectional white lights on the FATO will be installed according to the PTS-VPT-DSN specifications from EASA (given in [2]).

In the case of the vertiport at the airport, the FATOs will be placed at the ground level, marked with a luminescence paint, making the FATO visible to the pilot during the day and at night. Furthermore, fencing must be installed in the airport vertiport to distinguish between the security-restricted areas, accessible airside areas, and general passenger-side areas. This fencing could be made up of steel wire rope mesh, which is flexible to install and easy to place at different locations within the scope of the distinction area.

Other modular facilities, such as the passenger terminal areas, are to be built with unhinged accordion folding partitions or walls made up of a series of panels that fold in on themselves and are bifold. The passenger terminal would also include foldable chairs for passengers to sit and a screen to display the UAS schedule. Similarly, a room for building the operations centre for the vertiport to manage, and another room is built as the same structure as a passenger terminal. This operation centre will include foldable chairs, tables, monitors, a Central Processing Unit (CPU), a mouse, a keyboard, and communication

devices to communicate with the pilot, U-space Service Provider (USSP) and the Air Traffic Control (ATC) centre for manned aviation, and a radar system to locate the said UAS. Furthermore, in both these vertiports, it is essential to have a wind direction indicator in the shape of a truncated cone of lightweight fabric installed horizontally on a vertical shaft with orange and white stripes.

The aforementioned details enclosed some modular aspects for the desired vertiport. The painted FATO design could always be repainted at the airport vertiport to form an FATO for a bigger UAS or a full-scale Vertical Takeoff and Landing Capable Vehicle (VCA). Similarly, more containers can be placed together to increase the size of the FATO at the urban vertiport, thereby accommodating various VCA/UAS sizes. Hence, the modular design will bring the possibility of expansion at DLR for future VCA operations.

Bibliography

[1] EASA, "Special Condition Vertical Take-Off and Landing (VTOL) Aircraft," SC-VTOL-01, 2019.

[2] EASA, Vertiports Prototype Technical Specifications for the Design of VFR Vertiports for Operation with Manned VTOL-Capable Aircraft Certified in the Enhanced Category (PTS-VPT-DSN), Cologne, Germany: European Union Aviation Safety Agency, 2021.

[3] EASA, "AMC and GM to Regulation (EU) 2021/664 on a regulatory framework for the U-space," 2022.

Biography

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Dr. Samiksha Rajkumar Nagrare is a researcher at the German Aerospace Center (DLR) with a primary focus on vertiport operations and integrating them in conjunction with U-space and drones. Earlier she was with the Indian Institute of Science (IISc), Bangalore for her PhD specializing in the area of Unmanned Aerial Vehicle (UAV) Traffic Management (UTM). She is also an avid drone pilot.