Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	I-Tan Chen
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Studio		
Name / Theme	AR3CP100Complex Projects / Bodies and Building	
Main mentor	Jelmer van Zalingen	Academic
Second mentor	Jan Van de Vort	Building Technology
Third mentor	Edyta Milczarek	Research
Argumentation of choice of the studio	Complex Project, Bodies & Building Berlin delves into nine building typologies and design possibilities, explicitly focusing on Berlin, Germany. The study of architecture is associated with the development of advanced technology in aviation as well as an open mind to innovation when examining their connection to cultural and public surroundings. Berlin stands as a compelling instance of transforming and advancing development dynamics that have played a pivotal role in shaping the city's present architecture. The introduction of the Bodies and Building Berlin studio significantly influenced the decision of choosing the graduation project to engage in the studio and, more specifically, the airport typology. As a graduation student, Complex Project allows me to contribute to a studio that embraces collaborative and interdisciplinary methods in design and research endeavours.	

Graduation project	
Title of the graduation project	SKY HUB

Goal	
Location:	Rummelsburger Bucht, Berlin, Germany
The posed problem,	As Germany's capital city, compared to 2022, in 2023, Berlin welcomed a great increase in visitors, at the same time, Because of the concern about climate change as well as the goal of zero pollution action by the European Commission, it is time to make an effort to figure out an innovative alternative to deal with the substantial demand for transportation services as well as the new urban centre within the city. In 2021, Berlin municipality announced the diesel driving bans, which can justify the environmental sustainability to the citizens and promote low emissions to reduce air pollution. Moreover, in the Vision of Berlin in 2030, the authority aims "…It will be successful and sustainable in terms of climate and energy, city-friendly and futureproof in terms of mobility, its inhabitants caring and committed to living together in a modern and socially responsible society. …" This research will examine the potential of coordinating with the diverse vicinity and architecture ranging from traditional to conventional evolution, aiming to shape a safe, intelligent and sustainable transport facility proposed thanks to the pursuit of unparalleled quality of life and Advanced Air Mobility (AAM) development.
research questions and	**Research question:** How can we establish an innovative aviation infrastructure into a city centre? – What if Berlin established a new aviation facility to facilitate the European Union's ambition? – How can a vertiport content the society's sustainable and future

	proof concerns? What can be changed in the vertiport design? – What is the architectural fundamental of a vertiport?
design assignment in which these result.	The assignment will result in a design proposal for a new vertiport that will accommodate eVTOLs (electric vertical take-off and landing aircraft) within an agglomeration area within Berlin City. The project will challenge the evolution of aviation facilities located in the inner city from horizontality to verticality. The resulting project will produce a design brief, an intervention to integrate aviation infrastructure into an urban centre through contemporary architectural design. The design brief research consists of programme, site and client. Each of them will be processed following research, analysis, and a conclusion for the design proposal that will be treated as the design strategy for the next step. Regarding the programme, by identifying the fundamental spaces and the adjustment of the programme, the aim is to get an informative benchmark that can capture key aspects and parameters of vertiport design. About the site, the study will include 5 scales from potential locations, site analysis, positioning and volume study. For clients, the involved parties and structure of clients, stakeholders and consultants will be covered. The design brief links all client, programme and site ambitions to the project's main goal and research questions.

Process

Method description

Based on the literature reviews, quantitative study and a series of precedent studies of Vertiports, Heliports and airports, the Research methods will follow sub-points Typology, Program and Relation scheme. The first step is quantitative research for the

number of passengers per hour following the minimum sqm required for the Vertiport design for the estimation of the terminal building's GFA (Gross Floor Area), the necessary number of flights satisfying the passengers per hour and the fundamental area for the airside. All estimations above and calculations for this research are following the book, AIRPORT ENGINEERING: PLANNING, DESIGN, AND DEVELOPMENT OF 21STCENTURY AIRPORTS by Norman J. Ashford, Saleh A. Mumayiz, and Paul H. Wright in 2011, and the research article, Design Criteria and Accommodating Capacity Analysis of Vertiports for Urban Air Mobility and Its Application at Gimpo Airport in Korea by Byeongseon Ahn and Ho-Yon Hwang in 2022 and the report, Study on the societal acceptance of Urban Air Mobility in Europe by EASA(European Union Aviation Safety Agency) in 2021.

Programme:

The program study is divided into two parts: the percentage of Airside and Terminal buildings and the percentage of key programs within the terminal building. Firstly, the difference in the percentage of Airside and Terminal buildings is used to clarify the sizes and capacities between the heliport and proposed vertiport design projects mentioned above. Secondly, the program breakdown of selected airports will be used to analyse the main programs within an airport: check-in, passport control, security check, baggage claim, luggage, gates, and arrivals. The average percentage of program breakdown will be the preliminary program bar for the Design Brief of a Vertiport terminal for the next design phase.

Initially, A qualitative examination of the literature was taken, specifically focusing on the books "Airport Systems" by Neufville et al. and "Airport Planning" by Ashford. These sources provided insights into airport processes and a breakdown of programs. Subsequently, revisiting the selected heliports and airports enables the study of program breakdowns and program bars for key spaces in each airport. The preliminary program bar was created by averaging the program bars of different precedents. The program breakdown excludes processes not applicable to a vertiport, such as the absence of baggage handling and claim services due to exclusively carry-on luggage. Additionally, the mentioned literature review findings enable the research to dissect each key space into functional areas further.

Site:

In this research, the site location must follow three specific rules designed by the assigned Group. As a result, three main rules need to be obeyed. The common ground of the Group, Material, is sourcing. Following the idea, there are three rules: accessibility, Reuse and Prominence.

For accessibility, the main requirement is to select the site location within a one-kilometre distance of existing waterways or railways for construction transportation.

Regarding Reuse, 33% of local materials are required, which should be sourced within a one-km radius of the site. The last point, Prominence, is that the site location should be at a represented area of Berlin following the map made by the Material group to showcase the material collection of nine typologies.

Based on the Group's required rules for site location, to further develop rules for the proper site location of Vertiport, precedent studies of Heliports and qualitative research

of Vertiports' landside indicate several points for the inner-city location. Firstly, in terms of vertiports vicinity, restaurants, hotels, parks and other public shared facilities with the value of tourism. Secondly, regarding public transport, vertiports

Client:

The study relies on an analysis of existing literature. The literature review of this research focused on airport ownership structures and investigated the relationships among various stakeholders in vertiports. The findings revealed that airports are commonly owned by both government entities and private stakeholders both software and hardware. The government typically oversees infrastructure, while private stakeholders, such as airlines for airports and eVTOL developers like Lilium, Volocopter, Uber, and Airbus, as well as car developers like Hyundai and Volkswagen, contribute to the hardware.

Literature and general practical references

Selected precedents:

Vertiports:

- Sky tower, United State
- Gimpo Airport, Korea
- Lilium, Germany

Heliports:

- Heliport de Monaco, Monaco
- Edmiston London Heliport, United Kingdom
- Downtown Manhattan Heliport (JRB), United State

Airports

- Haneda Airport, T1/2, Japan
- London City Airport, United Kingdom
- Paris Orly, T1/2, France

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Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

   The project, SKY HUB, aims to deal with the future potential of aviation infrastructure in Berlin City, which also benefits the society by adapting innovative technology development such as eVTOLs and environmental concerns like low emission of an alternative transport option.

   This project reflects on the essence and importance of architecture as a catalyst to a city and as an influencer to represent the characteristic or identity of a building typology as well as a city, which goes beyond the built environment to human behaviour.

   SKY HUB, as a terminal building, will satisfy the demand for advanced technology in transport and the transformative of the civic centre. By constructing the narrative with the research of Materiality, airport typology and Berlin City, SKY HUB aims to be a benchmark of the technical and spatial evolution of aviation by combining the programme with the concerns of security for an aviation infrastructure and the connectivity with the surrounding vicinity.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

   Concerns about climate change have always been mentioned not only in technology development as well as in architectural design. The development of eVTOL is an excellent example of the desire for advanced air mobility, which not only improves the noise and air pollution of traditional aviation but also challenges the conventional architectural design of airports. From a societal aspect, the introduction of inner-city vertiport somehow challenges the traditional design requirements of airports due to environmental concerns. Architecturally, because of the limitation of empty plots within a metropolitan area, the connectivity, accessibility, sustainability, and durability of the building for current and future society can be treated as an essential opportunity to show users how architecture can co-exist with the environment and society. For a city like Berlin, this project as an evolution of airport typology can act as a benchmark of the typology expressing the cruciality of the concern for the environment and humans.

   The intersection between the relevance of scientific framework, research and design is the technology development of eVTOLs based on the pursuit of advanced technology and concern for the environment. SKY HUB aims to propose a series of strategies for future aviation infrastructure design as well as the integration of the facility with the civic life in the city. The research, design strategies, and results can be viewed as a scientific framework that can be adapted in future scenarios.