Flyshare 2020

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A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Architecture

University of Washington

2018

Committee:

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Program Authorized to Offer Degree:

Architecture

University of Washington

Abstract

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Transportation termini link people to social wellbeing, economic prosperity and the natural and built environments of the world. Altering and managing trends in transportation presents a major challenge in contemporary cities and will require the collaboration of stakeholders at local, regional, national and international levels. This research identifies flyshare and vertiports as one system solution for the growing congestion of existing transportation modes, through an emerging near-earth, vertical-takeoff-and-landing (VTOL) aircraft that will redistribute overcrowding and engage underutilized technology for the benefits of project stakeholders and transit users. The greatest operational barrier to deploying a VTOL fleet in present-day cities is a lack of sufficient locations necessary for take-off and landing sites. The design intent and functionality of vertiports and vertistops is fundamentally considered in regards to user convenience and experience. Cities and organizations that implement a flyshare system can embrace an opportunity to liberate transportation from two-dimensional confines and captivate the use of on-demand technology and service to create faster, more sustainable means of daily navigation.

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For Jane,
my vessel of knowledge,
ever-adjusting her sails to navigate me
through all the imaginable winds.

i. Preface

We often refer to the golden age of flying. It was sometime after the middle of the last century, a past time which was both the dawning of the new age but seems such a small moment in time that took ten-fold the amount of energy and investment to create than it did to break apart its greatness into regularity. Even though airports, or rather, all transit terminals are mostly the same as they have been for around sixty years, something, a collective attitude, is demanding a revolution. The elements of airports and our daily commutes that aren't changing are met with numb user acceptance of conditions; blank faces sit in terminal seats, glooming stares are exchanged from car to car along a grid-locked highway somewhere in the world right now. How do passengers express their disinterest in the current experience of navigating terminals and city streets? They escape through their gaze down into their hands, where faster, quieter machines connect us to one another instantaneously without any commute; the expiration of travel congestion is the age of smartphones.

My iPhone's Passbook alerts me, "Alaska Airlines flight, 4:45 pm," across my home screen, giving me all of my essential information from one single swipe of a finger: boarding pass, gate number, boarding and departure times, and maybe a boarding group. The experience of flying is so aided and reinvented by handheld digital support, yet physical air terminals are different, stuck frozen in time. Another application on my iPhone informs me, "you will arrive to work at 9:12 am; you are on the fastest route despite the usual traffic," which so successfully informs, but does not escape the reality of the gridlock I will soon endure. The act of travel frames so many events; from unfathomable boredom to life-changing romance, from high adventure and risk to daily grind, we are a world on the move, getting to where we're going, pausing in a fleeting moment that connects to the next one-hundred million moments after. Commuting is the dismal monotony of society yet also the very institution of our growing, globally-connected future.

At some point along a traveler's miraculous airport journey, the goal is to be aboard an actual aircraft or vehicular object, moving you towards your destination. Flyshare's air-traveling machines are the ultimate component of this new terminal's purpose, but they are admittedly only part of what this spatial discussion is about. Aircraft is a separate yet integral part of a passenger's experience of flying that fall outside of the

terminal. It is inside a terminal's spaces and intricacies that flyers perceive what it is to be a part of the flying public. Passenger experience is where my academic investigation commences. Personal-device technology and on-demand transportation culminate towards an emerging movement of anticipatory design which is something that leads us towards an automated, unified, more straightforward means of daily navigation.

ii. Terms and Abbreviations

AC	Advisory Circular, design guidance issued by the FAA
AI	Artificial Intelligence
Aircraft	a machine capable of flight
Airplane	aircraft propelled by powered, fixed-wing horizontality
Airship	aircraft propelled by a lighter-than-air gas
ATC	Air Traffic Control
DEP	Distributed Electric Propulsion
Drone	remote-controlled pilotless aircraft
EASA	European Aviation Safety Agency
eVTOL	Electric Vertical Takeoff and Landing vehicle
FAA	Federal Aviation Association
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
FCD	Floating Car Data
FATO	Final Approach and Takeoff (area and surfaces)
GPS	Global Positioning System
GSM	Global System for Mobile Communications
Helicopter	aircraft propelled by revolving, overhead rotors
HTOL	Horizontal Takeoff and Landing vehicle
IFR	Instrument Flight Rules
ITS	Intelligent Transportation System
ODM	On-Demand Mobility
OFZ	Obstacle Free Zone
PSA	Public Safety Area
RVR	Runway Visual Range
STOL	Short Takeoff and Landing vehicle; utilizing horizontal orientation of movement
Tiltrotor	VTOL aircraft that converts from vertical to horizontal flight orientation
TLOF	Touchdown and Lift Off (area and surfaces)
UAS	Unmanned Aerial Systems
UAV	Unmanned Aerial Vehicle
Uber	taxi technology company, operating in 633 cities worldwide (as of March 2018)
UX	User Experience
Vertiport	an airport for VTOL aircraft, with an identifiable grounds or elevated area
Vertistop	smaller vertiport serving a maximum of one tiltrotor aircraft at a time
VFR	Visual Flight Rules
VTOL	Vertical Takeoff and Landing vehicle

iii. Introduction

Aircraft, Autonomy and Rideshare

There are on average 1.5 million civilians in the sky at any one moment. The geographic mobility of the human population has become an irrefutable principle of modernization. Movement today appears to be a symbol of modern necessity, rather than desire or occasional indulgence which commonly describes its relatively short history in our global network.[1] Regardless of current air travel numbers, it is conceptualized – and reasonably accepted – that another form of travel will replace aircraft and commercial airports altogether in the near future. Conventional air travel has a threshold of success that has perhaps already been exceeded and is considered a hardly-sustainable mode of public travel.[2]

The relentless growth of commercial aviation has seen exponential technological advancement and research since its foundational beginning. New aircraft are being built far faster than old planes are being scrapped for material and recycling. In a mere matter of decades from now, commercial flight might not even involve a passage aboard an airplane. Air travel might not require a departure from an airport. Billions of dollars are being invested in alternative technologies to keep growing air travel capacities an up-and-running industry yet at any point in time it might be deemed obsolete. In economic consideration, commercial flight has created over 60 million present-day, primary jobs – not considering satellite means of employment such as off-site parking, rideshares or taxies for example – and currently generates more than $2 trillion (global metric, in U.S. dollars), annually. If considered its own nation, the aviation industry's GDP ranking would sit within the top twenty wealthiest countries in the world, placed alongside Saudi Arabia and Switzerland.[3] Most of the world's international airports are owned by a governmental entity (either local, regional or federal) that leases the site to private corporations that run its daily operations. Economic hierarchy and regulation are considerably different within every airport's financial structure, and this stems from a synthesis of a site's geographic location, history of design planning and construction, capacity demands, cultural values and socioeconomic shifts, social, financial wellness, and peripheral global markets.

Rideshare principles have the potential to create more profound multimodal relationships between vehicular traffic, public transit, and current air travel as we know it. Rideshare and potential flyshare systems are beneficial to users through the same ideologies of the share economy. The share economy has swept through news, media and casual conversation, defined as a description of economic and social activities, involving online transactions in an open-source community. It classifies peer-to-peer sharing via digital, on-demand online markets or resource cataloging. Here are three hypothesized benefits of rideshare systems that aim to permanently change cities' transportation methods, making the concept a viable consideration for long-term solutions and mimicry throughout other industries.

1. Economy

    Less self-driving means money is saved that would otherwise be spent on the maintenance, gas, parking, and insurance of personal vehicles. These money-saving effects divide out with every added passenger to a rideshare or flyshare trip. Rideshare also creates a way of earning money as a driver. Some people drive as a side hustle; others drive full-time.

2. Environment

    HOV lanes alternatively fueled vehicles, and PV inlayed roadways are examples of offsetting the harmful environmental effects of conventional transportation which increases greenhouse gas (GHG) emissions and global warming potential (GWP). Flyshare can be added to this list for helping cities' harmful transit practices because it decreases the dependency on extensive, heavy-carbon roadway infrastructure and utilizes high-efficient aircraft that could soon be 100% electrically charged (eVTOLs).

3. Safety

    International studies have concluded that rideshare drivers consistently operate a vehicle more safely that average drivers behind the wheel and they have also drastically reduced urban drunk driving incidents. A semiautonomous or autonomous VTOL system has the potential to mimic and replicate these positive effects.

Automating a global fleet of either ground-oriented vehicles or aircraft for rideshare/flyshare has many potential benefits attached to it. There are already autonomous vehicles, robotic co-pilots, autonomous long-endurance aircraft, computerized emergency overrides, and numerous other active features of AI, that enhance the safety and delivery of people and goods being flown today.[4] Global infrastructures that could enable autonomy would combine the strength of existing systems with the advancement of capacity and reduction of error for commercial and military systems not operating solely for human transit (i.e., FedEx, field mapping, inspecting a building, or enabling an aircraft to navigate safely). Autonomy would also help to moderate the predicted shortage of pilots the world will need in the near future; as flight capacity increases, a lack of experienced pilots would hamper the overall growth of air travel. Boeing estimates the industry will need 637,000 new pilots over the next twenty years which will be met by a drastic shortage of qualified people if strict examination and regulation policies remain for pilot licensure.[4] Notable investments in aircraft autonomy have come from Boeing's HorizonX venture, Airbus, SpaceX, NASA, Amazon Prime Air, Northrop Grumman, Lockheed Martin, Google, the Teal Group, the royal family of Lichtenstein's investment fund, a co-founder of Twitter, China's Tencent corporation, Daimler Chrysler, and Virgin Group's Richard Branson. This doesn't even begin to include the list of established companies that are responsible for the design and manufacturing of entrepreneurial aircraft components such as the OXYS Corporation, InvenSense, Ambarella, TransDigm Group, and Germany-based Lilium, along with a long line of startups sprinkled throughout Silicon Valley, the Pacific Northwest, China and all over the rest of world.

The Meaning of Flyshare

Flyshare is an airborne rideshare system that operates off the principle of providing on-demand transit with variable, demand- and market-based pricing. Present commercial flight can be considered an existing network of flyshare but one that lacks the possibility of same-day, competitive flexibility for users to successfully plan for travel on a moment's notice. Furthermore, the use of smart device technology and parametric comparison does not currently support weighing travel options between modes of ground and air transit. There is not an in-application comparison of times, distances and prices of multimodal transit legs between land and air (i.e., rideshare to an air terminal, flight options, and rideshare from a second

terminal to a final destination). The terms vertiport and vertistop are coupled with this new type of systematic travel, flyshare because they alleviate the prerequisite that all public air traffic must depart and arrive at conventional airports which are increasingly constrained by physical horizontal boundaries, strenuous means of financial support and paralyzed safety capacities. Vertiports and vertistops will support a vertical-takeoff-and-landing (VTOL) aircraft or eVTOL (electrically charged) aircraft. To adequately consider a new system and a new terminal typology, it is essential to understand the principles and history of terminal characteristics and clustered hub travel.

Chapter 1: Urban Termini

Terminals are famously complex, ever-changing, people-moving machines. The actions associated with a transit terminal seem to suggest an outbound, inbound play of movement but also seem to consider the space itself as an endpoint. Latin terminus, is “a bound, boundary, limit, end,” or “forming the end or extremity” or something.[5] Considering the vast history of metropolises and their transit systems, revealing the characteristics of flattering and less-than-flattering termini is vital to classify for the sake of transportation heritage. Travelers who want simplicity, a way to move from Point A to Point B have looked at their options with both a sense of awe and a sense of dread depending on the opportunities at hand. Great icons of transit are understood to draw the drama and romance of traveling dreams (Chicago’s Union Station, Copenhagen’s newly design Nørreport), but a less-publicized smaller role of terminals is equally essential to these successful systems.[6]

People have generally been migrating from rural to urbanized settings for centuries, which has progressed differently and at different rates around the world. Many areas have urbanized without significant reliance upon cars and sprawl of suburbs. A small portion of the world population affords automobiles, but these so significantly increase congestion because of the limits of supporting infrastructure. Personalized vehicles also produce considerable air pollution, which poses a significant safety risk to cities, and exacerbates feelings of inequity. High population density will be increasingly supported by a multimodal development of walking, bicycle transportation, motorcycles, buses, and trains. This chapter dissects the nature of centralized transit in unique, ununiformed patterns of urban development witnessed particularly in the United States.

1.1 Termini Typologies and Characteristics

Authorities in charge of transit terminals vary across political and geographical boundaries. There are typical overlying authorities behind transit typologies, infrastructure that supports those types, and controlling entities of daily functionality and operations. In many cases, the infrastructure of a terminal itself is either controlled by a proprietary transit authority that utilizes the space or a publicly governed power that oversees it. Two essential differences between contemporary rideshare and public

transportation systems are the privatization of on-demand technical delivery (created by in-app interfaces of Uber, Lyft, etc.) and physical fruition of terminals, funded by and planned for specific modes of transit besides rideshare vehicles. Physical terminal spaces can be categorized geographically into the following sections of regionalist thinking.

Downtown Terminals

There are two underlying principles of downtown, central business district passenger transit stops. The first principle is frequency and physical location in relation to the densest blocks of workforce and residents. The second element of downtown terminals is economically driven which creates a public statement or show-piecing of a terminal and its design, location, and defining contribution to the city it is located in. Commercial, political and real estate leaders had historically controlled these central stations with a “mouths that fed” attitude towards providing when and if they pleased to solve city transit issues with deep pockets and even more profound embedded power. On the analytical thinking of contemporary urban planning, central stations often must answer for a balance of urban stops and transfers compared to the efficiency of peak-demand traffic flow, planned future development, changing city demographics and real estate trends.

Downtown terminals are also the most influenced by a confluence of transit modes. One central station might serve interurban railway, regional railway, industrial/commercial railway, cross-country railway, bus depots, taxi and rideshare lanes, streetcar lanes, helipads, tramway circuits, waterway ports, airports, and perhaps soon, vertiport platforms. These transit modes offer an increasingly on-demand approach to navigating cities for residents and visitors alike.

Outlying Stations

Outside of central cities, some terminals aim to provide less exclusive, analytical solutions to navigating back and forth between suburban living and the diverse regional offerings of a metropolis. Outlying terminal locations offer people time- and money-saving solutions to

commuting to and from a city center or to a similarly-linked geographical area beyond a city's core districts. These stations will less frequently have a confluence of transit modes meeting at one particular location or in proximity to one another because of the efficiency and nature of radial dispersion of urban growth. The research supporting sprawled terminal locations is usually evaluated by overall demands, effective management of transit transfers, cost-efficiencies, and re-routing based upon clustered growth and user proximity. In a continuing desire to attract more users, the planning and execution of regional transit depots will often engage with neighborhood and community input rather than rely on leaders' and authorities' opinions alone.

Regarding terminal size and capacity, both centralized and outlying stations create environments for people to depart, arrive, wait and convene during their journeys of travel or commute. As the world becomes more and more connected by transportation, the way people interact with terminals and their integrated functionality will change alongside the priorities and expectations of their users.

1.2 Terminal Urbanism

Flyshare is an idealized addition to existing transportation. With expanding user options, comes the ability to maximize the efficiency or experience of people's travel - no matter if it's driven by the passion to reduce GHGs, GWP, money spent, or time endured, a flyshare system has the potential to benefit every person navigating cities. Even for individuals weary of near-earth aircraft travel, VTOLs and flyshare will lessen the number of people congesting conventional modes of travel. As cities will continue to grow, traffic congestion and public transit systems will be pushed beyond their limits. Sustainable solutions and affordable, reliable public systems will have to reinvent the way people think about urban travel. One company's mission (Uber) is to create transportation that is as reliable as running water, everywhere, for everyone and this stems their research efforts in flyshare.

Terminal urbanism and emerging flyshare systems are most potent when linked to on-demand provision and data-referenced location. Bypassing monumental site opportunities, and business-oriented demand, there is a significant social aspect to the planning of these systems that can be designed to plug less-

privileged people and places and connect them to conventionally inaccessible spaces – rooftops, waterways, private cores, and terraces, etc. – in cities. This movement would enable passengers that are usually limited by their income, or literacy as they navigate complex metropolises, whether it be for the first time as visitors or the thousandth time as local residents. The notion of airborne urbanism not only liberates cities from two-dimensional constraints but also supplies an emerging, technology-inclined, moderately educated middle class – that has a modest amount of disposable income – an on-demand version of public transportation. Planners have the opportunity to embrace such an idea, supporting the incipient, globalized, techno bourgeoisie.[17] Beyond this particular case of user-group, flyshare has the potential to empower under-served, underprivileged citizens and curve advantages of upper classes. No longer will a penthouse be solely privatized, and transit tunnels shunned to below-earth terminals. The verticality of the public can be reimagined.

Chapter 2: Logistics of Flyshare and Vertiport Systems

Uber announced on September 25, 2016, that the company was researching urban transportation solutions through airborne vehicular travel.[10] This came after the company's initial endeavor with helicopter service. In July 2014, Uber partnered with a company called Blade, to offer helicopter rides from New York City to the Hamptons for around $3,000 one way, through its service called "UberCHOPPER." In 2016, Uber partnered with Airbus to trial run "UberCopter", a $63 Uber helicopter service in São Paulo, Brazil. In another partnership with Blade, the company also provided helicopter service for specific events, including the Sundance Film Festival with flights from Salt Lake City International Airport to Park City, Utah.

Jeff Holden, Uber's Head of Products explained that the company wants to invest in providing "customers as many options as possible to move around… [and] doing it in a three-dimensional way is an obvious thing to look at."[10] Uber published a 99-page white paper[10] exploring the possibility of developing a "fully electric, vertical-takeoff-and-landing plane" network within ten years. The development of the program is expected to encounter prolonged safety and regulatory obstacles – the Federal Aviation Association is currently inundated by the increasing volume of concerns on aircraft technology, policy, and pilot licensure in the United States. The number of hurdles to overcome for Uber are menacing, but the enlightenment of the imagined system isn't just nearing euphoria, it is an utterly triumphant explanation of the future. It is geared towards solving the very real and growing problems of traffic congestion, road rage, aging infrastructure and limitation, fossil fuel dependence, and wasteful commuting hours that might otherwise be spent with family or at work growing our economies. Prolonged road time that confines the world's most powerful cities equates to lost productivity, more and more money spent on fuel—and a marked increase in people's stress levels: The *American Journal of Preventative Medicine* published findings, for example, that people who commute more than 10 miles were at increased odds of elevated blood pressure.[10]

2.1 Target Cities

Specific case studies conducted by transit researchers for Uber suggest that urban geographies and design characteristics of an individual city will require extensively unique density (or scarcity) of vertiports and vertistops. Unsurprisingly, there is most frequently a high density of long-distance trips starting or ending in central business districts and mass transit hubs. This is particularly evident surrounding the complexes of large airports like Los Angeles International and London Heathrow.

Figure 1: An Uber comparison of existing commute times/prices and estimated initial, near-term, and long-term VTOL times/prices.[10]

It is expected that longer daily commutes in heavily congested urban and suburban areas, under-served by existing modes of transit will be the first use cases for urban flyshare. Cities of such consideration include Los Angeles, San Francisco, Sao Paulo, and New Delhi. This is predicted by to two factors. The first is that the amount of time and money saved by commuters is increased by trip length; flyshare will have most considerable appeal for those traveling longer distances and durations. Second, even though building a high density of landing site infrastructure in urban cores (e.g. on rooftops and parking structures) will take some time, a small number of vertiports could absorb a significant share of long-distance-commuter demand since the “last mile” ground transportation component will be small relative to the much longer commute distance overall. Feasibility barriers prose ambitious, critical challenges that must be addressed before on-demand urban air transit can be realized in current markets.

2.2 Infrastructure: Existing and Planned

Developing a city’s capacity for VTOL infrastructure will require a data-driven consideration of current transport demands and future patterns of commuters. Conveniently, rideshare companies have such data, alongside every other geo-oriented application in use on smartphones. The amount of infrastructure that will need to be developed will be based upon demand, current infrastructure of a city, and if that infrastructure requires repurposing. In many instances, it is presumed the existing scale of infrastructure will be insufficient. Engagement across multiple levels of government, communities, and private sectors will surface contextual concerns that will be factored into development and flight operations, as well as vehicle design. A vertiport will require location analysis and feasibility planning, VTOL charging capabilities, and hierarchy of operational efficiencies to solve the airspace security and public challenges created in growing, diverse cities.

On-demand aviation has the potential to reinvent cities and urban fabrics, under the same founding principles of the steel-structured skyscraper. It would allow cities to use limited land more efficiently through three-dimensional urban airspace that alleviates ground congestion. Uber anticipates a network of small electric aircraft, VTOLs, to reliably transport people between suburbs, cities, and interurban hyper-commutes. The development of flyshare infrastructure will likely have significant cost and resource

advantages over heavy-infrastructure approaches such as roads, rail, bridges, and tunnels. Repurposed tops of parking garages, existing helipads, and even unused land surrounding highway interchanges could begin to form the basis of an extensive, distributed network of vertiports or single-aircraft vertistops. As costs for traditional infrastructure options continue to increase, the lower price and increased flexibility provided by these new approaches may give compelling possibilities for new and aging cities alike.

2.2a Considered Sites

Site consideration for vertiport and vertistop locations is vast and exploratory. There are three commonly understood examples for potential vertiport and vertistop sites; first, the tops of existing buildings and parking structures, second, waterway piers and barges and third, unoccupied land adjacent to existing noise and environmental impacts such as highways.

2.2b Design Assumptions

The following are a list of intentional parameters, holding each consequent vertiport or vertistop design responsible for meeting these requirements. These are mostly statements supporting public safety and function. Many have limitation to the actual performance of aircraft.

1. All riders take no more than one VTOL leg (i.e., VTOL layovers are not considered).
2. Loading and unloading time of passengers takes an average of 3 and 2 minutes, respectively.
3. Takeoff and landing times are predicted to take 60 seconds and 75 seconds, respectively.
4. Design parameters are a 50’ diameter pad, a 115’ diameter Final Approach and Touchdown (FATO) area, and a 200’ diameter Public Safety Area (PSA) or controlled environment.
5. The PSA threshold is not required on rooftop locations (since the area is controlled).
6. The time from a rider’s origin to a departure hub is determined by first converting the Haversine distance to an estimated routing distance using a factor of 1.42, and then applying the average speed from the actual trip.

7. A rider is eligible for a flyshare route if and only if the estimated duration of the journey is at least 40% faster relative to the expected length of the ground trip.
8. All requests are met on an on-demand basis, and scheduling rides in advance are not considered viable.
9. Max VTOL distance is 120 miles.

2.3 Market Feasibility Barriers

If critical factors of development and policy align in the next decade, the VTOL ecosystem is believed to be achievable. Stakeholders that will empower or restrain the idea as they work collaboratively include regulators, vehicle designers, cities' communities and citizens, network operators, investors, and digital and physical designers of infrastructure. NASA and the FAA recently spearheaded a series of On-Demand Mobility (ODM) workshops to bring the VTOL ecosystem together—emerging VTOL vehicle manufacturers, federal agencies, private investors, professional societies, universities, and international aviation organizations—to identify barriers to launching an on-demand VTOL service. The following are categorized by NASA, the FAA, and Uber as the most critical obstacles facing the development of on-demand urban air transit:

Certification. Rules and safety regulations must be satisfactorily in alignment with the aviation authorities granting permission to operate—these authorities are namely the United States Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) who actively regulate 50% and 30% of the world's aviation. The organizations assure aviation safety. VTOL aircraft certification progresses with new aircraft concepts, which has historically been very slow though the process is optimistically changing to coincide with the speed of changing technologies.

Battery Technology. Electric propulsion has many desirable characteristics to fuel VTOLs. It is the preferable choice for this developing aircraft, but current batteries are "promised" in the coming years to optimize for the longevity of performance. This boils down optimizing the weight

of a battery, its specific type of energy delivery components, its charge rate, cycle life, and its cost per kilowatt-hour.

Vehicle Efficiencies and Reliability. The call for a new type of aircraft stems from the inefficiencies in current-day proxies such as the helicopter. Helicopters are far too consumptive to be economically viable for large-scale operations. With a more constrained use case focused on ridesharing, a more mission-optimized vehicle is possible, e.g., utilizing distributed electric propulsion (DEP) technology. Vast efficiency improvements are possible because DEP enables fixed-wing VTOL aircraft that avoid the fundamental limitations of helicopter edgewise rotor flight, and wings provide lift with far higher efficiency than rotors. But no vehicle manufacturer to date has yet demonstrated a commercially viable aircraft featuring DEP, so there is the real risk of underperformance when design execution reaches commercial scale. Time and reliance are also crucial factors to be optimized by vehicle performance, particularly cruise speed and take-off and landing time, and system reliability, which can be measured as the time from request until pick-up. In this context, fundamental challenges are vehicle designs for 150-200 mph cruise speeds and hyper-efficient one-minute take-offs and landings10. Robustness in varied weather conditions is another concern, which can otherwise ground a large percentage of a fleet in an area at arbitrary times.

Air Traffic Control (ATC). With ATC systems precisely as they are, a VTOL service could be launched and even scaled to possibly hundreds of vehicles. São Paulo, for example, already flies hundreds of helicopters per day. Under visual flight rules (VFR), pilots can operate independently of the ATC. When necessary, they can fly under instrument flight rules (IFR) utilizing existing ATC systems. A successful, optimized on-demand urban VTOL operation, however, will necessitate a significantly higher frequency and airspace density of vehicles operating over metropolitan areas simultaneously. New ATC systems will support this exponential increase in complexity. Low-altitude operations can be ideally managed through a server request-like system that can

deconflict the global traffic, while allowing UAVs and VTOLs to self-separate any potential local conflicts with VFR-like rules, even in inclement weather.

VTOL Cost and Affordability. Current global civil rotorcraft production is only approximately 1,000 units per year, lacking critical economies of scale. Simpler, quieter and more operationally efficient vehicle designs of VTOLs are proposed which leverage digital control rather than mechanical complexity. Uber expects that this shift can kick-start a cycle of cost and price reduction.

Safety. Federal Aviation Regulation (FAR) Part 135 operations (for commuter and on-demand flights), on average, have twice the fatality rate of privately operated cars, but developers believe this rate can be lowered for VTOL aircraft at least to one-fourth of the average, making VTOLs twice as safe as driving. DEP and partial autonomy (pilot augmentation) are critical pieces of the safety equation.

Aircraft Noise. VTOL aircraft must be acceptable to communities they would serve, and vehicle noise plays a significant role in this. The objective is to achieve low enough levels of noise that blend into existing background noise; this means an aircraft would operate one-half as loud as a medium-sized truck passing a house. The measure of noise will be required to characterize the audible impact of flyshare on a community adequately. Electric propulsion will best meet this objective: it requires finessed design, both concerning engine and propulsion thrust noise.

Emissions. VTOLs represent a potential new mass-scale form of urban transportation; as such, they should undoubtedly be ecologically responsible and sustainable. Uber and other VTOL developers are dedicated to both the operational emissions of the vehicle and its lifecycle assessment, which accounts for the entire energy lifecycle associated with the manufacturing and transportation processes, including (in the case of electric energy) the production of electricity to charge VTOL batteries. This leaves energy generation (which today is still primarily coal, natural

gas, and petroleum-based) with its associated emissions as the primary concern. This topic is covered in depth, in Uber's publications.[10]

Pilot Training. Training to become a commercial pilot under FAR Part 135 is a very time-intensive proposition, requiring 500 hours of pilot-in-command experience for VFR and 1200 hours for IFR. As on-demand VTOL service scales, the need for pilots will rapidly increase, and it's likely that with these training requirements, a shortage of qualified pilots will curtail growth significantly. In theory, pilot augmentation technology will substantially reduce pilot skill requirements, and this could lead to a commensurate reduction in training time.

Vertiport/Vertistop Infrastructure in Cities. The purpose of this research, architecturally, is to ultimately address the most significant operational barrier to deploying a VTOL fleet in cities: a lack of sufficient locations to place landing pads. Even if VTOLs were certified to fly today, cities do not have the necessary takeoff and landing sites to operate at fleet scale. A small number of cities have multiple heliports and helipads, which might have the capacity to offer a limited initial VTOL service. Additional locations would require optimized, predetermined locations that are readily accessible from street level and have space available to add charging stations. If flyshare is going to achieve close to its full potential, infrastructure will need to be added.

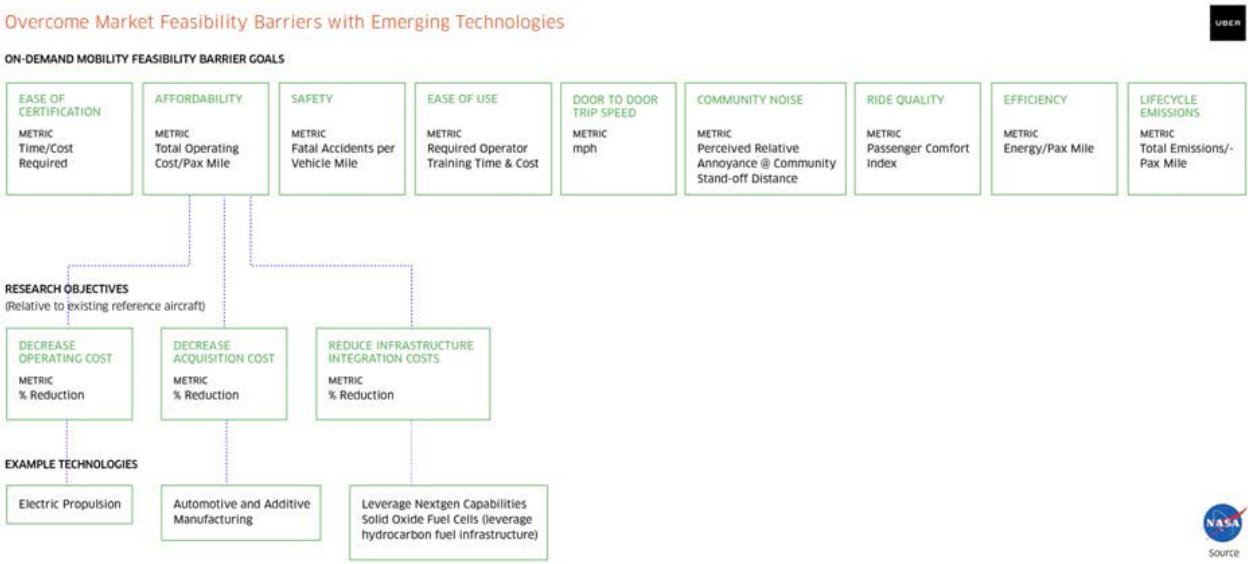

Figure 2: Summary of findings. NASA and FAA workshops for On-Demand Mobility (ODM).[10]

Chapter 3: Urbanistics of Flyshare and Vertiport Systems

We live in post, post-modern times.[18] Our communities are growing into Smart Cities and are adopting City-as-a-Service ways of thinking and living.[19] There are public private partnerships, chicken egg street vendors, tent cities, aging infrastructures, network radio wave wars, sewers, Teslas, the mafia, and elderly baby-boomers all existing in the city. It is lively sorts of melancholia and ugly sorts of beauty. Urbanity serves its citizens by doing the most and the best in which it can with what it has in its hands.

> Keller Easterling's, "Glossary Uber," *Art Papers* — 2016[9]
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> The name should threaten relentless upbeat sharing. It should suggest an invasion of market share or a modern imperative to kill the father and flatten the incumbent. Like the advent of any new technology, it must extinguish all previous knowledge and all render previous technologies obsolete. To suggest coexistent logics is to stand in the way of the superior successive logics. And the destruction should be treated as a principled stance—something that is "good for everybody." So the name has to be a universal elementary particle that would combine with anything, neutralize anything or become any part of speech—preposition, prefix, adverb, adjective, noun, and verb. There is no "one and the many." There is only "the one." If you quote Ayn Rand and whisper it with an umlaut, "ew-ba" can stand for nearly any preposition—over, above, beyond, across, around, spanning, circumscribing, covering, surrounding, blanketing, or conquering.
>
> The logo should prompt totemic rituals of belief, reverence and loyalty. It should align with everything from the ying-yang logo of the Technocracy movement to the Kryptonite logo of the ethereum blockchain. It should be poised to connect everything into one closed loop if only nonbelievers and other details can be eliminated. If you put your feet on the table, sharpen your elbows and bark it, "OO-ber" means adverbs like super, supra, mega, trans or omni in too many combinations to mention as in uber rich, uber ambitious, uber fast, uber powerful.
>
> The logo should have the upper-left-hand-corner shine of digital stuff on a metallic black and white. The look and feel is a flirt, a transparency, a reflection, a sparkle, a gleam. From the corner of your eye, as you descend into the backseat, you should glimpse the hood ornament of a luxury vehicle and get a whiff of Modern. It's now a scent, and your handsome driver is wearing it. If you kiss and release all five finger tips of one hand and say it through velvet, ooooo-ber becomes an intensifying adjective meaning transcendent or

ultimate—something ranked at the apex of its class as in uber infrastructure, uber app, uber luxury, uber upholstery, uber man.

Middle-management suddenly has a chauffeur. Anyone can snap their fingers and cars begin to float toward them. It only requires a haughty but nonchalant insider jargon. These users are just too busy crushing it to use anything but acronyms and choppy sentences. If you tug at a cuff-linked cuff and say it like it was your own cartel, "ubr" has become a noun as in: "I never take cabs. My PA will get you an uber."

But economic and political dominance are nothing without the broad conquest of slang. And this is evangelical sharing, so everyone's user scenario has been written. The elderly have mobility. Parents have a car pool. Party-goers have a date waiting outside. How can you not know about this? If you roll your eyes and saying it holding on the r, "u-berrrrr" has even become a verb as in "Are you going to miss everything or are you going to uber (or "uber it.")? And the answer must always be Uber. Totally.

3.1 Implications of Additive Architecture: Jacques Derrida and iPhones[11]

Parasites vs. Ecology vs. Transcendentalism: what are the times we live in? Jørn Utzon is most know for this term who claimed we live in an additive world where nature and culture add to the organization and order of society.[20] In this context, branching away from Utzon's thinking, additive architecture, or additive design, can be considered a physical addition or an extra, unstated program to a space's comprehensive content – literally adding spatial implication – and it is an act that is carried out in hopes of benefitting the original, pre-existing conditions. Allow this alternative definition to serve as the guiding principle of thought.

In 1959, Jacques Derrida asked: if genesis already exists in all conceived structures, must not the definition of the beginning, wherever the point of genesis occurred, be pre-created?[23] Flyshare creates a dialogue about the effects of technology and the iPhone, share economies and Smart Cities in comparison to our historic understanding of urban planning and community design. We must conceive in order to perform. That is the burden of design. Our history exists as we jump in the flowing river of time and human collective dreaming; The past will inform while our dreams will

conceive. Don't forget about your Microsoft Zune. You can't. Architecture has for too long been a silo and a slave to history and to the Microsoft Zune when it should have always been serving the musicians and the producers of the music that was being placed on the Zune.

Consumers and digital religion shape the future. They say what it is to be good. Too many of our rules that we are enslaved to are no longer productive. Our theorists and our philosophers address religion and societal hierarchy when our contemporary technologies disarm these same ideals. Do future generations worship a God or an application? In the amalgam of personal devices, automated living is desired and feared. It is unclear where architecture is headed and what design means for the present or future. As we shift from modes – modes of technology, modes of transit, modes of living, modes of feeling – we are translators mistranslating. We interpret noises and words and expressions that create an already preconceived idea about something that either surprises us or fits into the prefigured compartments of our consciousness. For Derrida, the technological, automatic and mechanical could never simply be defined as external or opposed to the voluntary, conscious and spiritual. The articulation and repeatability of the trace means that there is something mechanic that is inseparable from the possibilities of meaning, choice and faith. Repeatability hangs in the air, created by the perfect storm of modernity and technology. It looms over our cities.

Now let us dare to add the components of data – arguably a form of technology more so than modernity. The articulation and repeatability of the trace means that there is something *manic* that is inseparable from the possibilities of meaning, choice and faith.

Part One. Grids: Types, Characteristics, Methodologies

The orthogonal grid, the informal grid, the implied grid, the electrical grid, the griddle, grid paper, geographical grid, urban grid, smart grids, grid blocks, grid plan, grid street plan, or gridiron plan, repeatable predictable grid, predictable repeatable grid, Manuscript Grid. Column Grid. Modular Grid. Hierarchical Grid.[24]

Figure 3: Archlibs Online. Twenty American grids compared at a graphic scale placed within a grid.

The grid, in any context, serves as our scaffolding of constraint. Site lines, setbacks, right-of-ways, thoroughfares, public access, easements, mineral rights, air rights, bandwidth rights, and subdivisions all set our stage. Is the biggest challenge an uninterrupted grid? Design's greatest opportunity is to address complete normalcy, the infill condition? Or is it the endless search for organic variation within any site, regardless of its normalcy or uniqueness?

Part Two. Smart Cities Using Grids[12]

An intelligent transportation system (ITS) is an advanced application providing innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and smarter use of transit networks. ITS may improve the efficiency of transport in a number of situations. Situations being: wireless communications, computational technologies, floating car data, floating cellular data, vehicle re-identification, GPS based methods, smartphone-based rich monitoring, inductive loop detection, video vehicle detection, Bluetooth detection, audio detection, information fusion from multiple traffic sensing modalities, emergency vehicle notification systems, automatic road enforcement, variable speed limits, dynamic traffic light sequence, collision avoidance systems, automated planning and scheduling, automatic parking, driverless cars, intelligent speed adaptation, map database management, road weather information systems, scalable urban traffic control, telematics and telematics 2.0, traffic estimation and prediction systems.[25]

Part Three. Data Centers and Grids: A Design Consideration[13]

Data centers will be referred to as data from this point forward. Data occupies one room of a building, one or more floors of a building, or an entire building. Most of the equipment is often in the form of servers mounted in 19-inch rack cabinets, which are usually placed in single rows forming corridors into a grid. Front and rear access is crucial for each cabinet. Servers differ greatly in size from 1U servers to large freestanding storage silos which occupy many square feet of floor space. Very large data may use shipping containers packed with 1,000 or more servers each; when repairs or upgrades are needed, whole containers are replaced (rather than repairing individual servers).[13] Local building codes may govern the minimum ceiling heights of data.

Architectural programming of data requires consideration of modeling criteria, design recommendations, conceptual design, detailed design, mechanical engineering infrastructure design, electrical engineering infrastructure design, uninterruptible power sourcing, technology infrastructure design, availability expectations, site selection, modularity and flexibility,

environmental control, stringered raised floors, stringerless raised flows, structural platforms, metal whiskers, electrical power, low-voltage cable routing, fire protection, security, energy use, greenhouse gas emissions, energy efficiency, energy use analysis, power and cooling analysis, computational fluid dynamics analysis, thermal zone mapping, green data, energy reuse, network infrastructure, central apparatus rooms, colocation centers, disaster recovery, HVAC, internet exchange point, Neher-McGrath, peering, server sprawl, and the Anderson Powerpole connector.[13] For dramatic effect, these are listed here as new design principles, guiding the shape of data centers and mass technological efforts to optimize and optimize only. When do we start to consider the spatial quality of a data center? If never, it is because of a lack of human interaction within the space, but certainly the importance of data center architecture will have its moment at some point in time.

Revisiting Part One, Two, and Three. Take Away, the Message of Smart Cities

To be smart, one must divulge the Smart City and its data with a liberated means of living. Create with smartness, move with smartness, prepare for smarterness and embody data. Be the data smartly. Content is unfiltered data. Filter the content smartly. Don't overpay for your coffee. Create the data smartly. Don't become the data. Embody the data. Allow the data to influence you smartly.

3.2 Power in Urban Hierarchy: Haussmann and Baudelaire

Demographic perception, universal collages and linguistics stand in our way. Since their earliest existence, human beings have collectively adapted to the changing nature of beauty. The art of living, and living happily, requires an acceptance with oneself in relation to society and time. An emerging transportation such as flyshare heightens the fleeting, ephemeral experience of life in an urban metropolis. It is so important to compare the powers of urban hierarchy and their influence on the healthiness of cities; comparing Haussmann's life work and Baudelaire's lyrical defiance, there can be reason for hope in the future of urban planning.

Planning power can be defined as the possession of legitimacy in the use of planning law; and since the legal framework is a site of contest rather than a source of legitimacy, planning power depends on external legitimation.[14] Haussmann was the power because he was a power supported by the highest power, the emperor. Civilians will succumb to powers above them after however many fights need to be lost. Baudelaire comes into play, as a civilian, because of his opportune grasp of normalcy. What do Haussmann and Baudelaire have in common? Their perceived sense of power creates their place in society – one being a chosen man to carry out a colossal urban renewal program of Paris, inundating entire neighborhoods with demolition, forced to resign for his extravagance, but successfully seeing out his visions, shaping the present day, central Paris as it is known today…[14] and the other a French poet producing work as an author and art critic, expressing the changing nature of common life and the of beauty of modernity and industrialized Paris during his time.[26,27] Who has more influence of the zeitgeist? Who would have had more social media impact?

Source: Comic Mint. The Jetsons "Speed Limit 5500" Signed by Bill Hanna & Joe Barbera

3.3 Obsolete Technology at an Urban Level

Cannibalization is defined as eradicating forms of outdated technology,[28] which stands as the contemporary rule of survival in an adapt-or-die global economy. The technoscapes of today allow technology to stitch together all the minds of the world, pulsing the electronic nerves of the population in order to stir our sensitivity to something larger than ourselves alone. The Jetson's set the stage for airborne transit decades ago; we know it can exist because our subconscious ability to imagine it has been stirred; kudos William Hanna and Joseph Barbera.[29] We engineer the future through art and expression (informed, of course, by whatever discourse of research and analysis we choose to conduct). We are broadcasters, more so now than ever before, through our smartphones, no longer solely inclined

to the stories or the experiences projected at us, but producing and publishing ourselves into the river flow, the growing monsoon of content in the world.

> **Tom Tobbins** calls upon a cyclone of untraditional thoughts, lifting the mind out of its cognitive Kansas.[30]
>
> **Terence McKenna** explains that technology is our skin and that humanity is simply taking in matter that has a low degree of organization and puts it through mental filters, and extrudes from it jewelry, gospels, and space shuttles. This is what we do. [15]

Our thoughts shape our spaces and our spaces project some range of goodness and badness back at us. We write our lessons-learned into the feedback loop, categorizing what is successful versus what is unpleasant. This is architecture. The methodologies we study and research and mimic shape a preferred way of thinking – habits are formed by the micro idiosyncrasies of repeated profession – which too often can result in a one-track mindset. In contrast, the devices and machines we engage with every day, open doors and channels of new design thinking. Technology has made our lives more convenient, but it has also made us subjected to unlimited amounts of choice. Too much choice has given us anxiety of possibility.[31] Freedom in this sense, is essentially oppressive because it hinders our efficiencies and enjoyment beyond technology itself. What then is the future of design? Anticipatory choice? Algorithms that know a person better than they know themselves will offer options of choice only when it subliminally makes sense, filtering away anything superfluous, undesired, to see/know/decide upon/ponder/consider/utilize mental RAM.[31] Citizens will never be bombarded by *too* much.

Chapter 4: Vertiport User Experience

It is time to consider the architectural implications of a system of vertiports and vertistops. The following chapter divulges into the human conditions of this new form of urban transit because that is ultimately, what should be created and aligned to the pleasurable and integrative characteristics of its design. Instead of the program diagrams, site analysis, massing options, and whatever other kinds of conventional requirements strewed through the pages of architectural texts, websites, awards, and documentations, find here the descriptions of users affecting the flyshare system. The stories and context of these users shape the typologies and design of vertiports and vertistops intended to serve them.

4.1 Stakeholders and Characters

To establish vertiport typologies in the context of one urban condition, a two-part approach developed a framework of design thinking. First, a list of stakeholders to create the flyshare system serves to inform parameters of each vertiport or vertistop. Second, a cast of fictitious characters serves as a guiding principle to user-experience design.

List of Flyshare Stakeholders

1. The communities that will accept and implement the system
2. Public assemblies and entities responsible for civic transportation, infrastructure, policy, and planning, digital privacy, and sustainable methodologies. These assemblies and organizations range from international, federal, and local scales, and formally represent communities.
3. Designers and engineers of eVTOL aircraft and other electric vehicular systems.
4. Designers and engineers of the vertiport itself, engaged by the user groups and contextual information of a vertiport's location, climate, capacity, and design intent.
5. The work force that is employed to maintain and serve the daily operations and functions of the vertiport (i.e. safety and air traffic control monitoring, facilities and digital management).
6. Public and private funders, directly invested in supporting the viability and feasibility of eVTOLs and vertiports. (i.e. Uber Elevate, Boeing's AirX, public bonds)

7. Subsidiary stakeholders, investing with exchange for: financial benefit, consumer interaction leading to potential financial benefit, and knowledge-share sources of research and entrepreneurship. (i.e. Tesla, Uber, Boeing, NASA, universities)
8. Tertiary stakeholders, investing in the programmatic support of a vertiport that will streamline or enhance user functionality and experience (i.e. Amazon, HelloFresh, restaurateurs, brick and mortar retail and services).

Considered Flyshare Rules and Regulations

The follow are a list of requirements or policy that, if implemented, would guide a public private partnership model of a flyshare system, benefiting the fight against climate change and consumerism.

1. Users arrive and depart a terminal, or vertiport, without the use of fossil fuel. This is monitored in-app, and regulated by near-site and on-site surveillance.
2. Services rendered onsite and tenant-procured goods within the vertiport are to be zero-waste. Stakeholders may use 100%-recyclable or 100%-compostable materials.
3. The space is continuously added to or replaced by the support systems needed for emerging transit technologies, chosen foremost by improvements made to energy efficiency. The vertiport is a centralized source for the electric re-charging of all transit vehicles. It dedicates its space to the leading most-efficient vehicles of transit first, allowing less and less efficient technologies to be replaced.

Fictitious Flyshare Users and Their Stories

1. Ari Gutierrez

Eugene, Oregon

Behind schedule on his way to a recruiting event at the University of Oregon, flysharing with two of his fellow assistant coaches of the men's distance track team. Being in the web and app development sector of the tech industry for more than twenty years, he's often asked to speak and collaborate with people across the region. In his spare time, he audits coding courses that teach non-majors the basics of app development.

Q: Favorite running shoe? *A: Brooks Adrenaline, a perfect balance of support and cushion.*

Q: Code to know? *A: Depends what you want to design for - web, iOS, or Android? Then you'll have your answer.*

Flyshare trips completed: 26

Flyshare distance traveled: 1068 miles

2. Oliver Lester

Burbank, California

Project manager turned contractor who is newly divorced since last autumn. Emerging himself into mobile apps, online dating and lifestyle technology, he utilizes near-earth flyshare to get where he needs to go quickly while providing a sense of that young-again spirit he's searching for in his day-to-day living. He's interested in multicultural religion, American muscle cars and is most frequently seen wearing a starched "Lester Construction" polo shirt with worn-in khakis or jeans.

Q: Vice on a lazy Sunday afternoon? *A: After a mid-morning swim, there's nothing better than an ice cream sandwich and people watching on the beach.*

Flyshare trips completed: 11

Flyshare distance traveled: 363 miles

3. Marisol Yu

Davao City, Philippines

Mom of two sons with an over-committed iCal agenda from now until late September. Administrative healthcare leader, finishing her Ph.D. dissertation discussing the implications of advanced

monitoring technology in expanded rural home care. She is most excited to finish her degree because of the added time she'll have for coaching her youngest son's baseball team this spring. Catching a flyshare commute to speed up a hectic morning with her oldest son; traveling from a dentist appointment, to a passport application appointment, back to his school in the heart of the city.

Q: Any more kids in your plans? *A: I feel balanced with two.*

Q: Usual modes of transportation? *A: My children and I tote ourselves around by moped, by foot, and by car usually.*

Flyshare trips completed: 12

Flyshare distance traveled: 471 kilometers

4. Ishcah Gremekken

Victoria, British Columbia

Retired dental hygienist flysharing from Victoria, Canada to Yellowstone National Park with the potential option to drop south thereafter to see the peak of the Blueblonnet season in the central Texas region. Traveling with her husband, Greg. They are self-described winos with nowhere to be with nobody in mind - retirement is seemingly just as beautiful as it sounds.

Q: Biggest life regret? *A: Should have stuck with piano.*

Q: Fashion or comfort? *A: Both, my readers match my socks and color coordinating is a must, something Greg might never learn.*

Flyshare trips completed: 5

Flyshare distance traveled: 914 kilometers

5. Rakib Malla

Chittagong, Bangladesh

Textile engineer and chemist, choosing to flyshare for a work-related exploration of naturally-sourced mineral dyes and coloring techniques. Avid electric guitarist and novice DJ in his band, Fleetmac&Cheese. When he's not working or jamming, he enjoys cooking with friends but is known to get in trouble for adding too much spice without warning.

Q: Favorite guitar riff? *A: The opening string of, 'I've Seen All Good People,' by Yes.*

Q: Textile you believe in the most? *A: Besides wool, it's Spectra or Dyneema, depending on the manufacturer, which were materials originally developed for ligament replacement.*

Flyshare trips completed: 46

Flyshare distance traveled: 2879 kilometers

6. Haley Vanraaport

London, UK

Student at the London School of Economics, recently admitted into the Global Master's in Management, and flysharing to visit prep school friends for a long weekend in Ibiza. Embracing the work hard, play hard phase of life. Currently weighing options of summer internships versus coaching youth tennis. Wondering if she has enough money at the moment to fix her laptop that is nearing its life's end. Phones her mother too little and her older sister too much.

Q: Living with college roommates? *A: Three of them who have a band together (and I actually like their stuff).*

Q: Is age just a number? *A: My body tells me I am 16 one day and 66 the next. I'd mentally like to be 35 so I am competitively hirable, but I have 13 years of learning to do between now and then.*

Flyshare trips completed: 39

Flyshare distance traveled: 2103 kilometers

7. Echo DeHaas

Arcata, California - Carson City, Nevada - Taos, New Mexico

Artist working mostly with metal finishes and welds. Handyman with a knack for fixing things you didn't even know were broken. Flyshares with most of his worldly possessions in two backpacks; he sells and works in places he feels drawn to by the street life, architecture, or timeliness of the season. His newly assigned zodiac sign (updated by NASA, September 2016), the Aries, is transcending him towards metal "painting" with fire.

Q: Favorite commissioned project? *A: Sun dial for a public elementary school.*

Q: Boxers or briefs? *A: Briefs, except during a grunge era, a style and time in which we might be re-entering any day now.*

Flyshare trips completed: 4

Flyshare distance traveled: 418 miles

The Plotline: An Ensemble of Los Angelites, Intertwined by Flyshare

OLIVER is helping RAKIB fix the suspension of his 1974 bronco.

RAKIB just released his first ep, but usually DJs for ECHO's band, fleetmac & cheese.

He just returned home this morning after he and the fleetmac crew performed up the coast at a festival over the weekend. He flyshares home from the airport, bypassing the morning rush hour.

He's pleased with the festival's results. Both Rakib and Echo are boasting 3,000 new Instagram followers in the course of the last 2 hours.

ECHO's running late to a marketing meeting with ARI.

He hustles to an adaptive reuse vertistop in the middle of a crowded intersection,

Could there be any more stairs to the top of this thing? The vertical pilgrimage makes him wonder if he should have searched harder for the elevator. Echo leaves Ari with the sketches they talked over which Ari seemed to really like.

ARI's interviewing HALEY, who actually wants to work for his boss, Greg.

Ari bids adieu to his interviewee and bikes to the flyshare research studio. His annual membership lets him meander through their newest exhibits on his way to the vertiport passenger area where he's dying to tell his barista about a new spin class that has amazing cardio intervals.

Ari's boss, Greg, is married to ISHCAH who cleans ECHO's teeth and introduced him to ARI.

Ishcah squeezes in a few quick errands at the marketcity vertiport downtown, checking her app to confirm her favorite egg supplier is there and hasn't packed up for the day. She's convinced these particular eggs cook more evenly in her baking. She wanders through the vendor stalls before catching a flyshare back home after a long work day.

ISHCAH and MARISOL are going to RAKIB's DJ set later.

After a middle school play dress rehearsal, Marisol chases her son up the landscape of a park's vertistop. They pause to enjoy the sunset and she hugs him goodbye. She sends her son in a flyshare to his friend's house and sends herself in a flyshare to meet Ishcah. She presses play to listen to Rakib's new ep that everyone is excited about.

HALEY's listening to the ep and also going to RAKIB's show after dinner with her uncle, OLIVER.

She buses to her campus's vertiport and wonders if her earlier interview went well. Her uncle Oliver will want to hear all about it.

OLIVER and MARISOL match on a dating app during dinner with his niece Haley, and the two agree to late night drinks. He flyshares to his favorite bar with a view and messages Marisol en route to ask if she'd like to sit inside or out because it's getting a little cooler since the sunset.

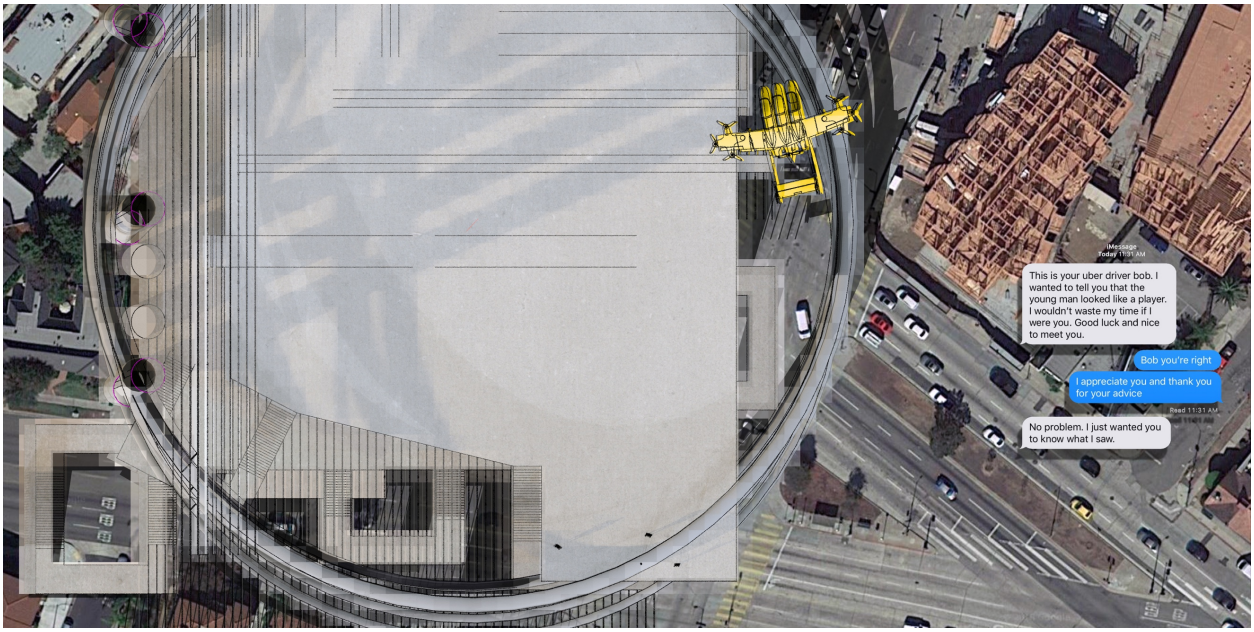
Meanwhile, RAKIB invites his husband ARI on stage to finish his set with a solo cover of bowie's "Fame." On their flyshare home afterward the show, they sit with a wide-eyed fan girl asking Rakib for a selfie and some dj lessons. Ari recognizes her, it's Haley, who he interviewed earlier and tells her she got the job. Rakib orders champagne to their destination vertiport and invites all his fellow flyshare passengers to an impromptu after party.

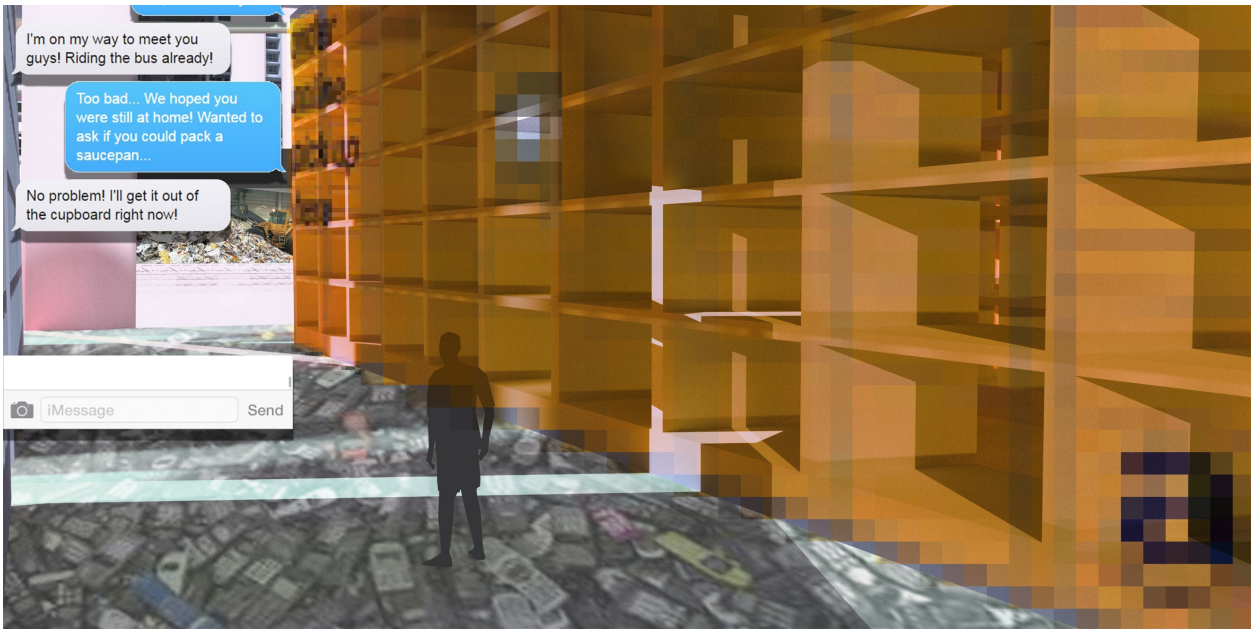
4.2 Case Study: Los Angeles

The Los Angeles metropolitan area initially stemmed from a series of decentralized towns, each with a self-contained system of housing, commercial districts, and economy. This founding development launched its early history into a rooted suburban disposition; individuals and communities were thought to best thrive from their unique localities. The growth of the region has wholly flipped these ideas upside down, with little land or natural resource to remain for the taking of future horizontal expansion.16 Towns and neighborhoods have sprawled and expanded into one another's jurisdictions, melded by the shared challenges and problems they face as density continues to increase.

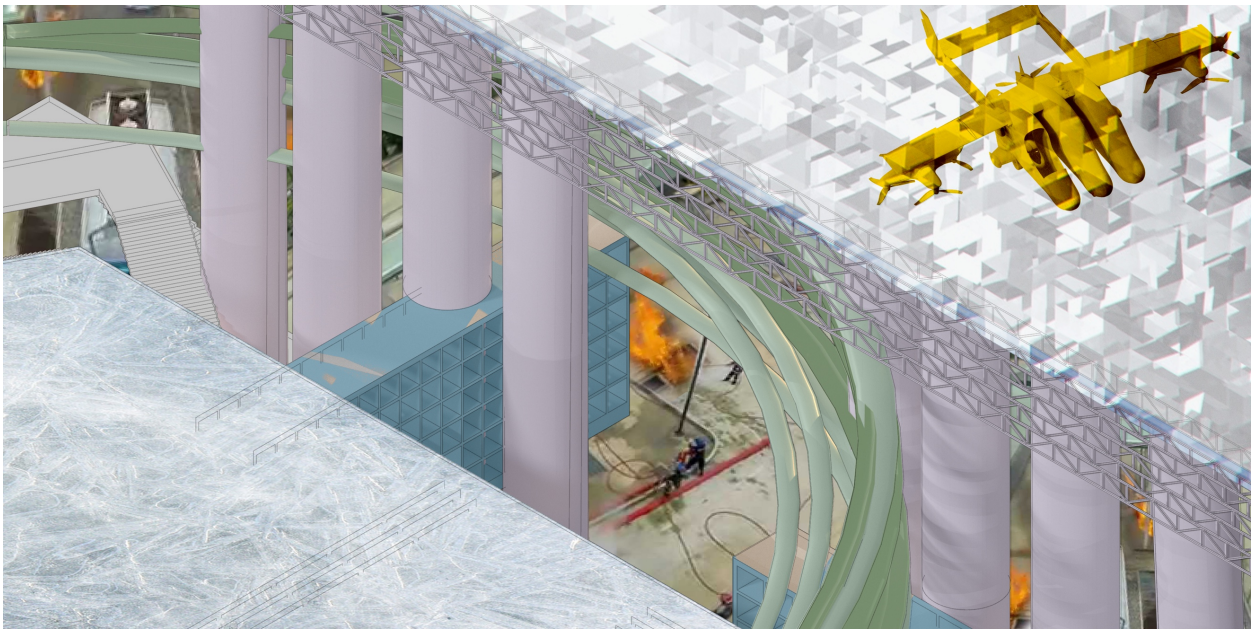
Through the realities of the aforementioned Los Angeles Condition, the architectural circumstances of a flyshare system will, in this research, be implemented in Los Angeles. To imagine flyshare users in a particular setting, and to explore ideas of typology and function, the following vertiports and vertistops are sited and studied in the Los Angeles context.

Fossil Fuel Apocalypse. An adaptive-reuse typology of vertiport that integrates into the fabric of existing modes of fossil fuel transit – parking lots, gas stations, highway clovers, etc. – and supporting services. Interface component: continual in-app route option comparisons of caloric energy used and time spanned (displayed for each potential option).




I'm on my way to meet you guys! Riding the bus already!
Too bad... We hoped you were still at home! Wanted to ask if you could pack a saucepan...
No problem! I'll get it out of the cupboard right now!
iMessage
Send


PALM SPRINGS
AERIAL TRAMWAY

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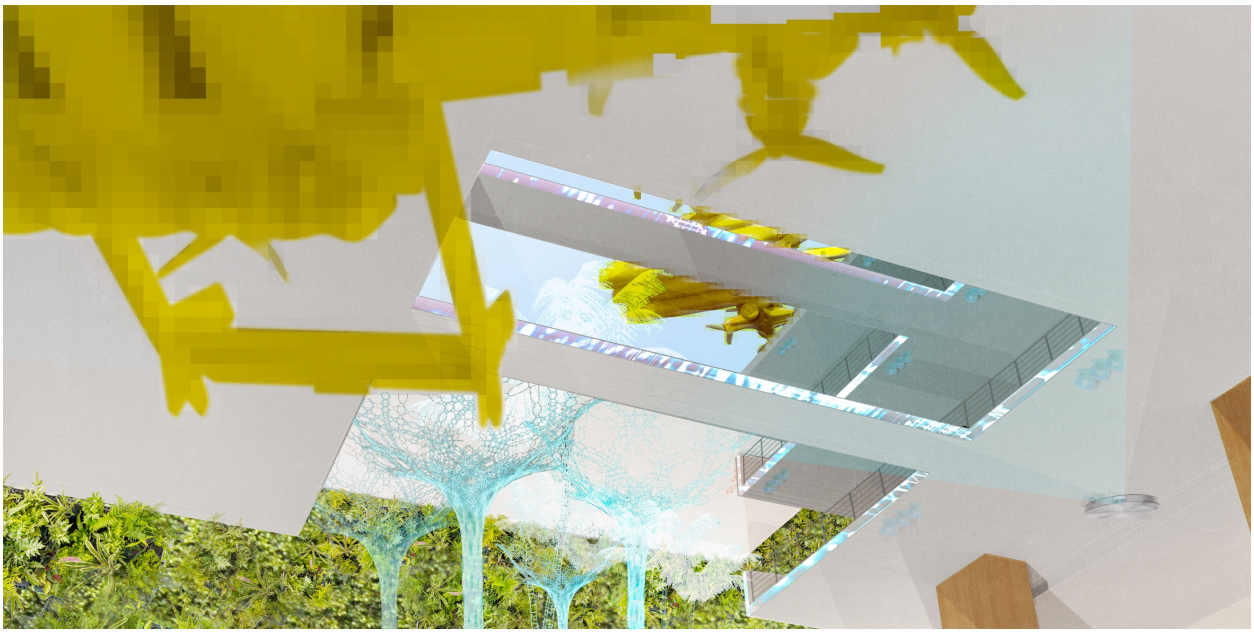
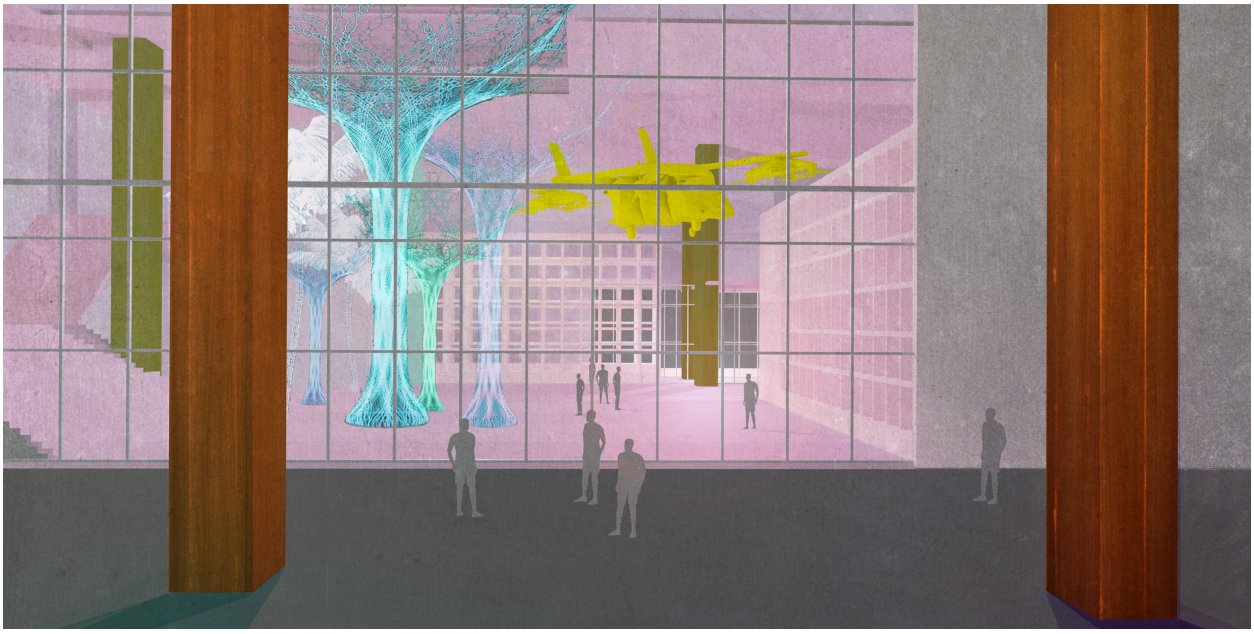
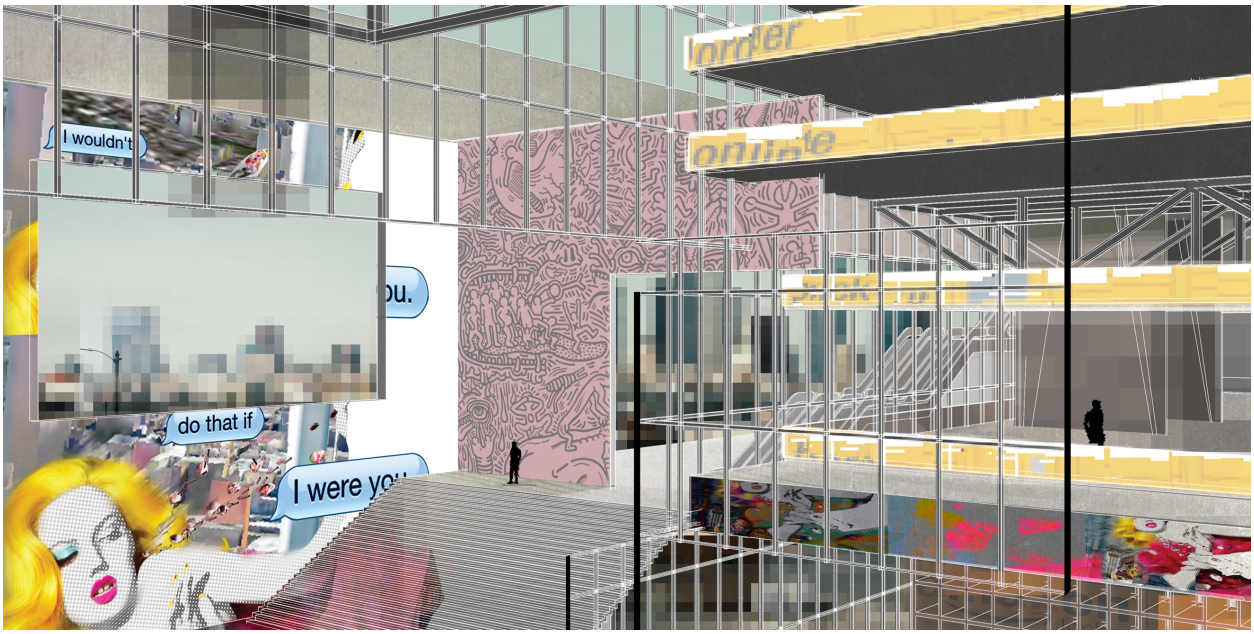
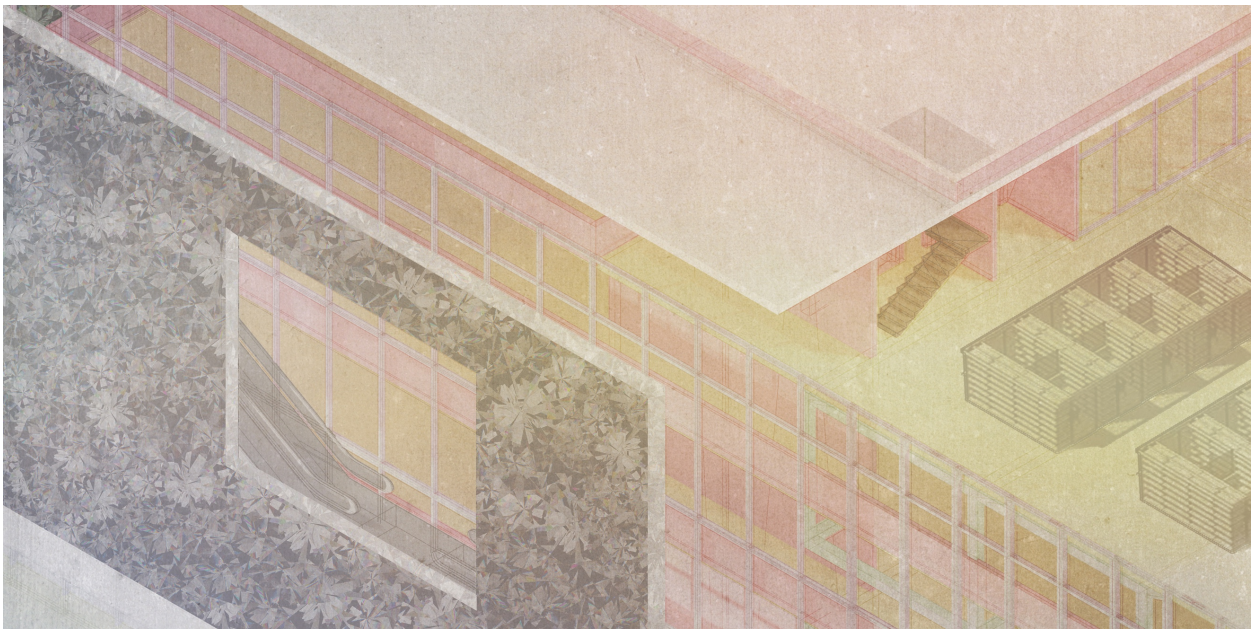
On-Demand Transit Research Studio. A space for research and public interaction of emerging technology and user functionality that serves as both museum and creative laboratory. User component: complete user control of work stations and environmental adaptation of light, air, humidity, heating/cooling, and electricity use.

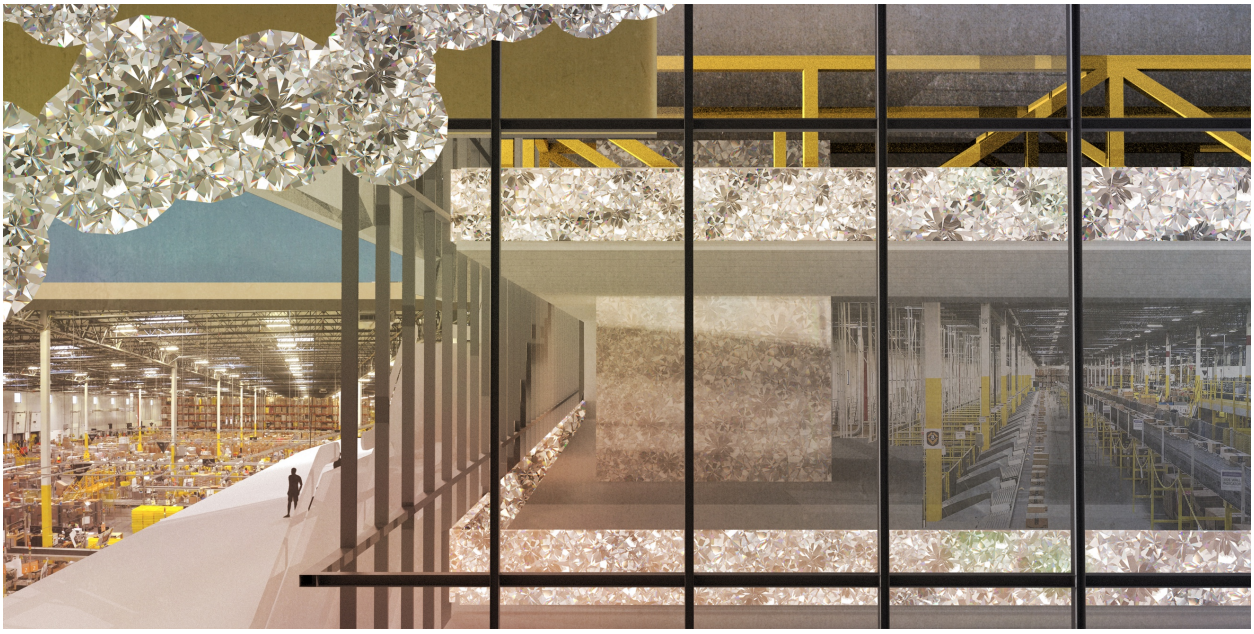




Civic Service, Regional Vertistop. A decentralized, adjunct example of outer lying fllyshare locations, attaching to localized conditions such as neighborhood libraries and community centers. Interface Component: digital projection of services, mapped in-app, through street-level and interior 360° views.





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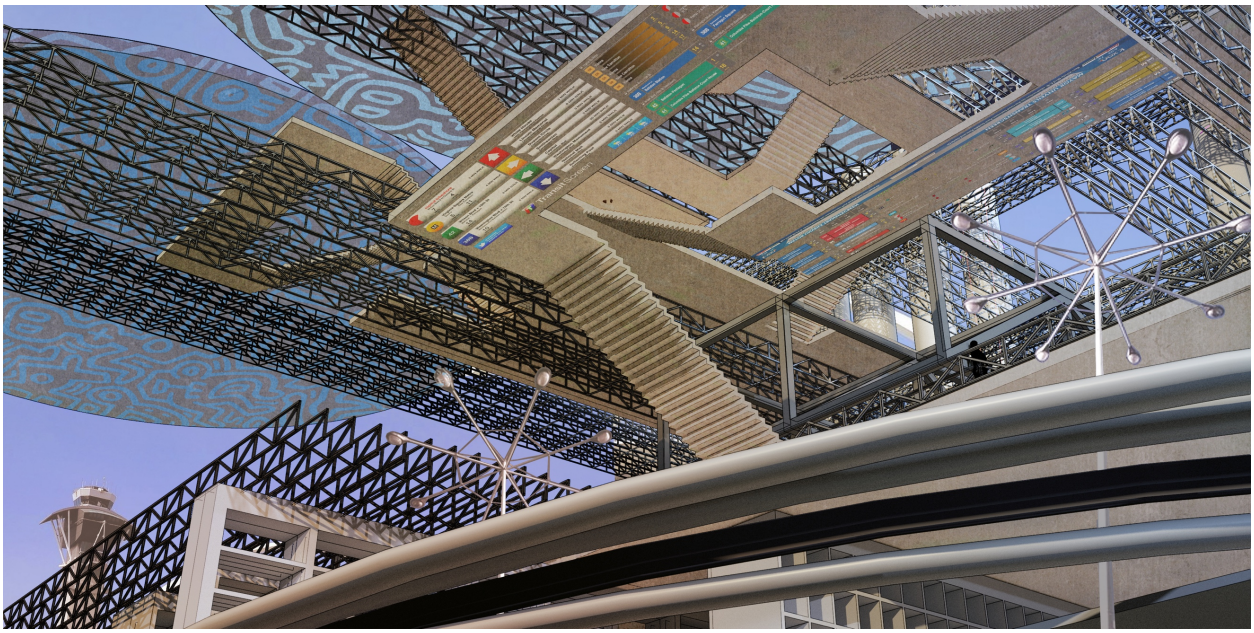
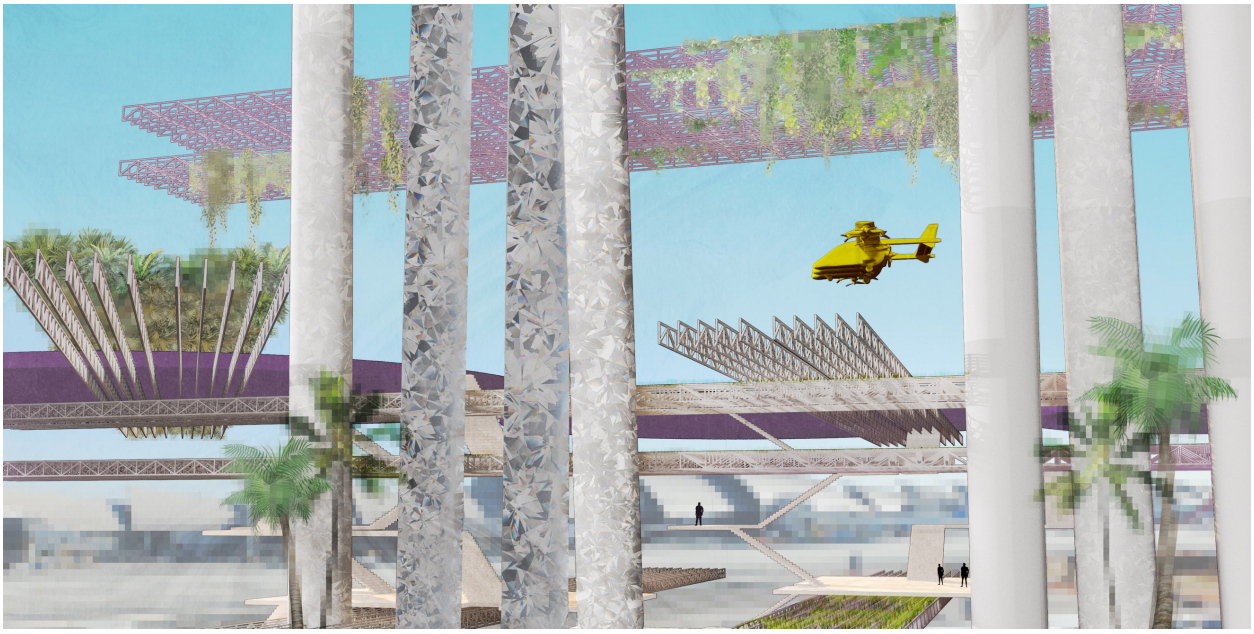
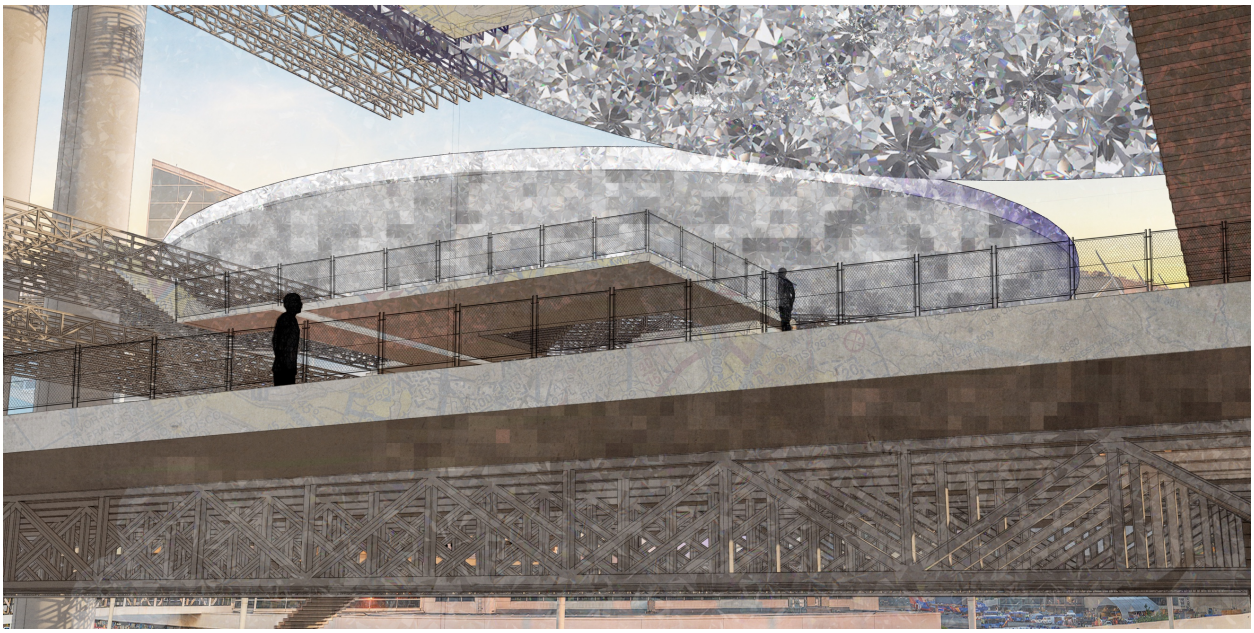
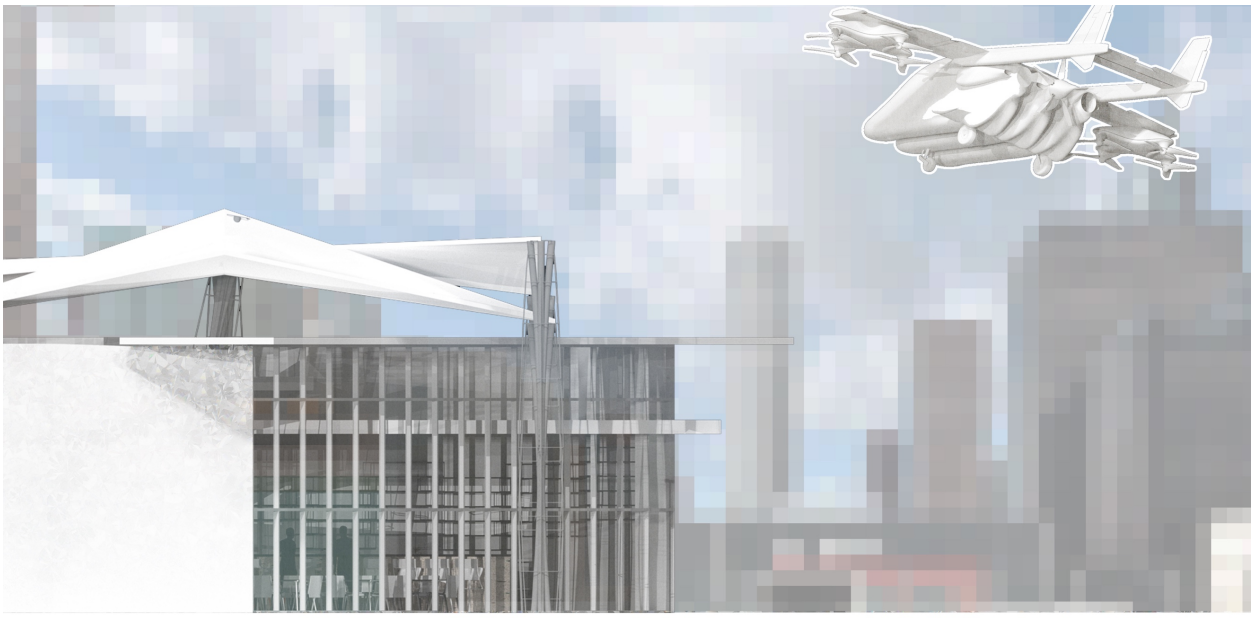


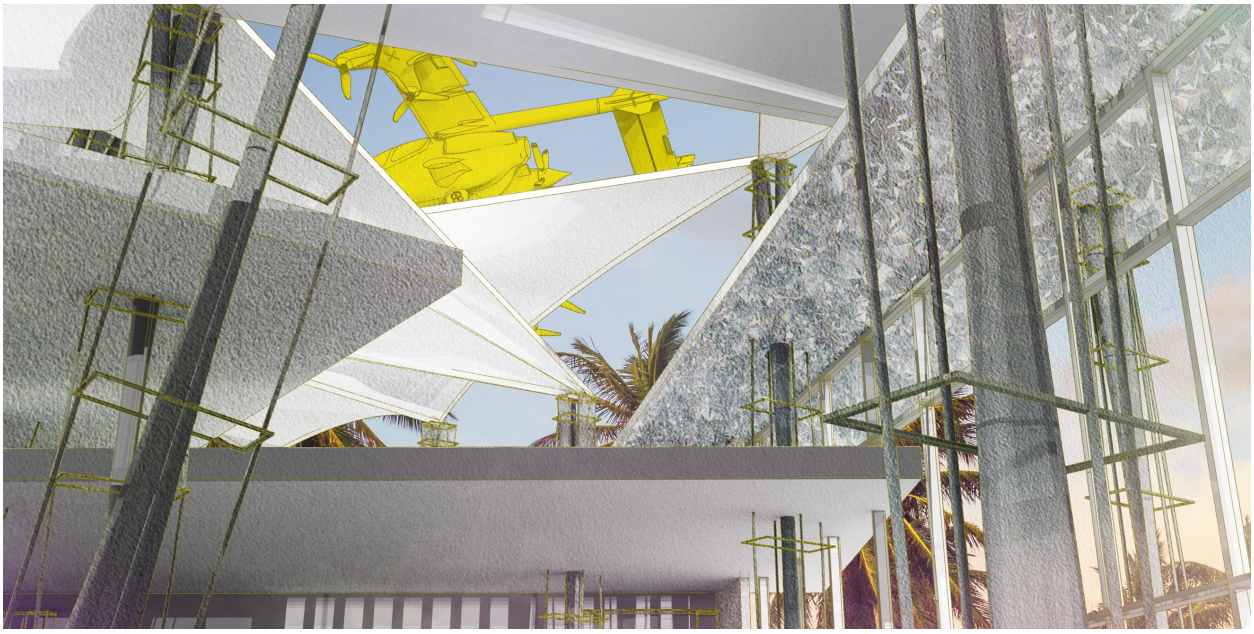





Virgin Australia LAX
PVR Zelus360
Street View - Jul 2016
Virgin
AX Parking P-4
Los Angeles International Airport
Google
Image capture: Jul 2016 Images may be subject to copyright. United States Terms Report a problem

Club Flyshare. Attachment to existing rooftop conditions, competitively marketed as a restaurant or bar. Anticipatory Design: pre-selected preferences of atmosphere, noise pollution, eatery variety and eligible singles.

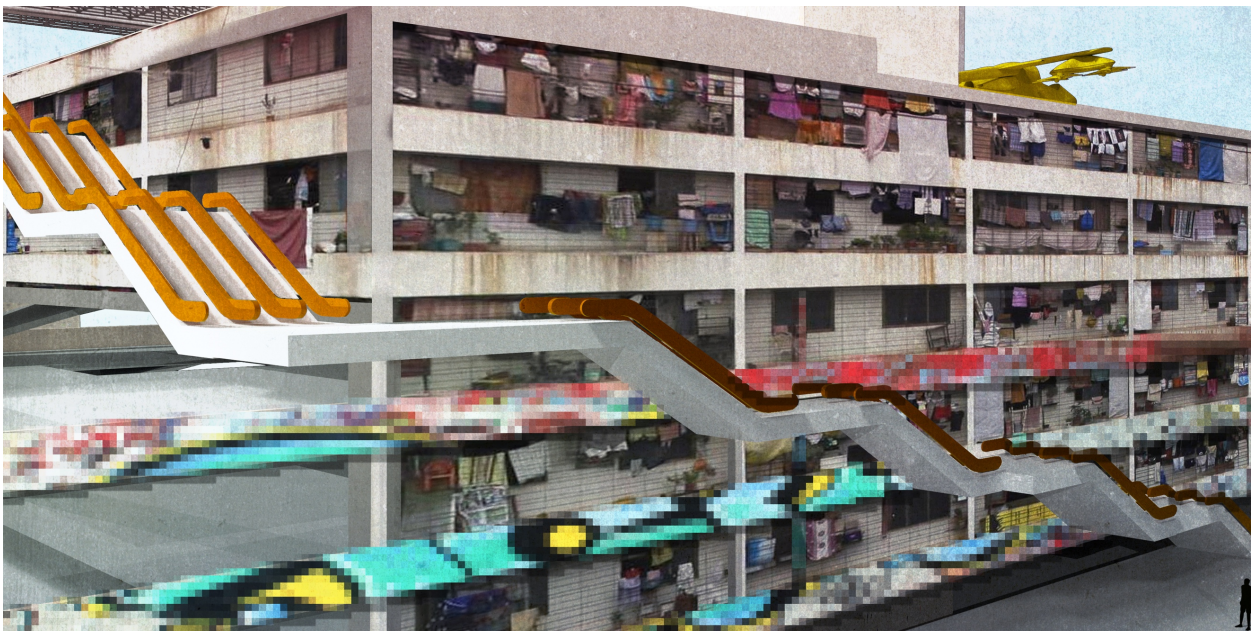





The Rooftop
Shailesh Soliwal
Street View - Dec 2016
Google
Image capture: Dec 2016 Images may be subject to copyright. United States Terms Report a problem


The Rooftop
Shannon Franzen
Photo - Dec 2017
Google
Image capture: Dec 2017 Images may be subject to copyright. Picasa United States Terms Report a problem

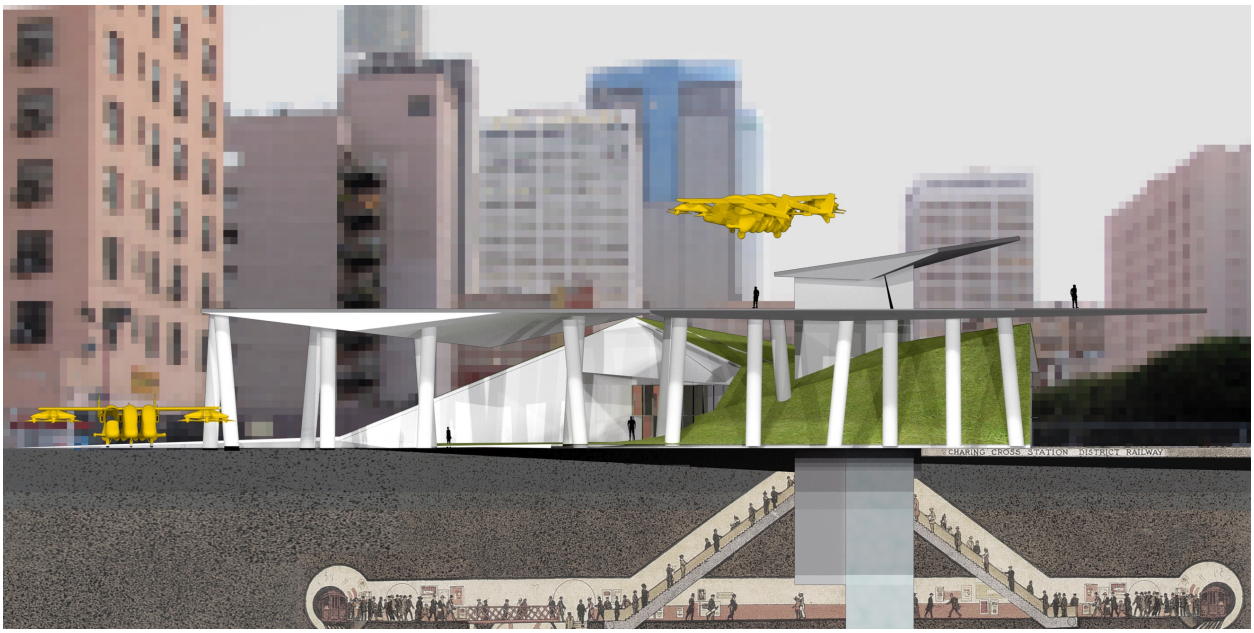
Additive Marketcity. Piecemeal approach to an additive nature of market stalls and infrastructure. Interface Component: cross references to-do lists and errand lists with physical distance from qualified vendor. Prompts with in-app ordering / delivery options.




Wilson Blvd & N Oakland St


10

Public Landform. Servicing plazas, parks and public open spaces with a transparent form of verticality and integrative context. Anticipatory Design: pre-selected space preferences guide users to optimal waiting areas.


CHARING CROSS STATION DISTRICT RAILWAY


Perch
Harikrishna Mehta
Photo - Jul 2016
Bar Thirteen
Intimate cocktail lounge & jazz bar.
Google
Image capture: Jul 2016
Images may be subject to copyright.
United States
Terms
Report a problem

iv. Conclusion: A Call of Consideration

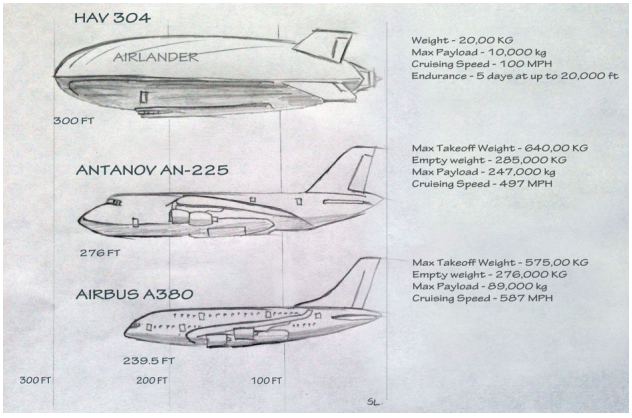
Flyshare and an urban system of vertiports is an important consideration of viable, on-demand transit that can reinvent the movement of people through growing cities. The future holds serious potential for a feasible deployment of VTOL transportation, backed by a collaboration of diverse, talented stakeholders who are experts, dreamers and believers in their various fields. A flyshare ecosystem will only be successful with the participation of entrepreneurial manufacturers, local and international officials across the range of leadership platforms, regulators, users, and with communities who will express a willingness to interact and understand how the ecosystem can shape the future. There are countless known and unforeseen challenges that have yet to be solved at all scales. Exploring the issues that are raised during research and prototyping will require a collaboration between a multitude of perspectives to find solutions to help accelerate urban transportation into realization. The profound and positive impacts of on-demand urban air transportation can reinvent urban mobility and the daily interactions the world has with technology.

Uber is passionate about on-demand urban air transportation and greater urban mobility. To share your ideas or express your interest in building this vision, whether as a pioneer city, VTOL manufacturer, regulator, infrastructure developer, user group or any other stakeholder, contact elevate@uber.com.

For further information and graphic demonstration of the concepts and fundamentals discussed in this document, please visit http://students.washington.edu/patnoe.

Appendix 1: Airlander 10

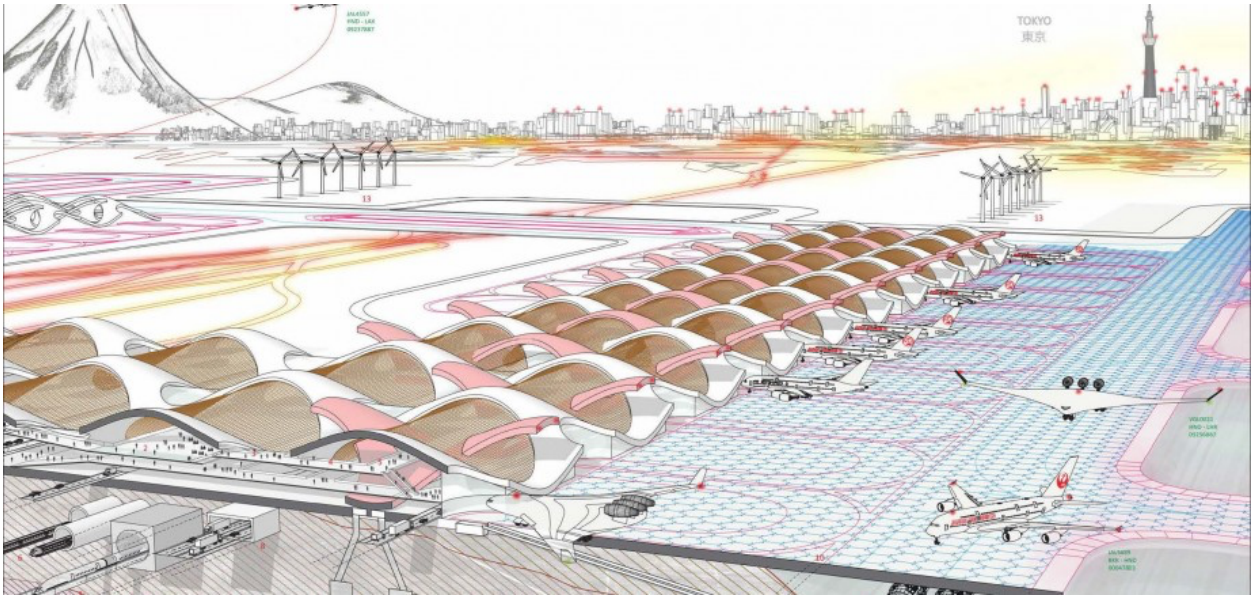
An aircraft so minimal (with no internal structure), yet so full of innovation.
This research development will ultimately fulfil a wide range of communication, cargo carrying and survey roles in both the military and commercial sectors all with a significantly lower carbon footprint than other forms of air transport. The largest aircraft currently flying can stay airborne for up to five days at a time.

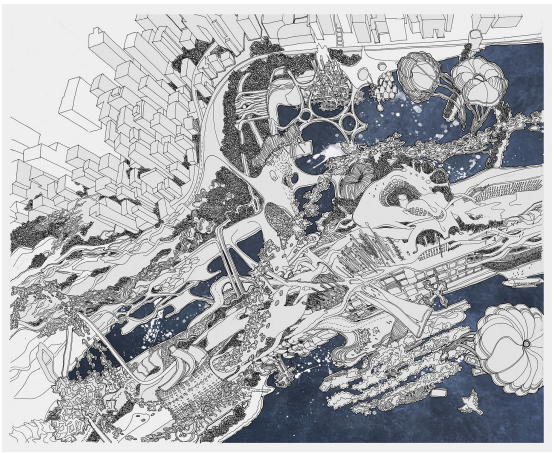


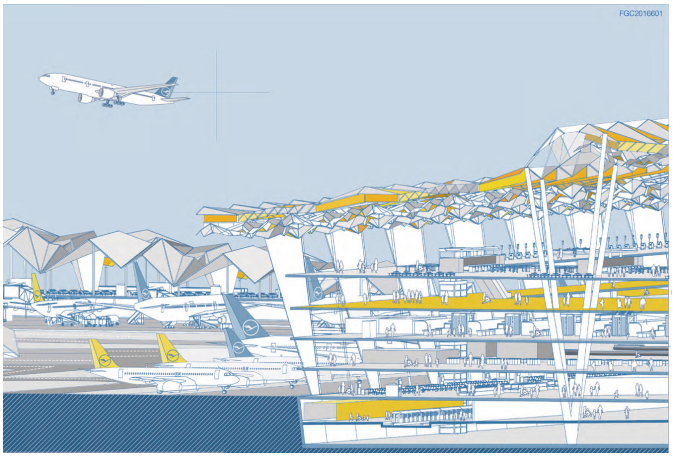
Appendix 2: Fentress Global Challenge

Airport of the Future, re-envisioning airport architecture in the year 2075

“Participants are encouraged to re-envision the terminal building in the year 2075, taking into consideration local context, technological trends, project feasibility and passenger experience. In line with the speculative nature of the competition, participants should seek to improve every dimension of the airport terminal building. All entries should delve into one or more broad topics related to airport architecture and the future of aviation such as urbanization, globalization, technology, flexibility, security, and adaptability.”



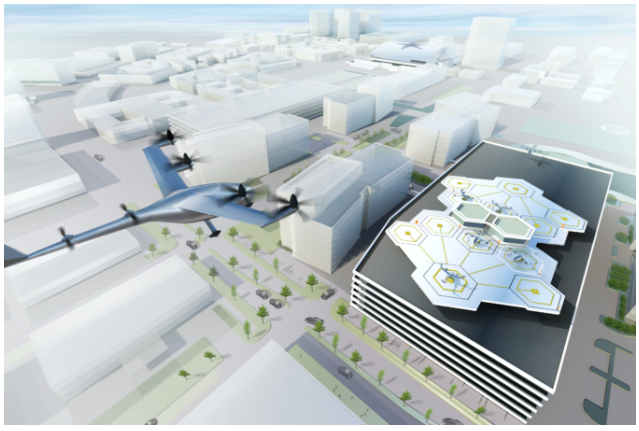




Appendix 3: UberAir

Fast-forwarding to the future of on-demand, urban air transportation.

“Vertical takeoff and landing (VTOL) aircraft will bring far-reaching changes to our cities and our lives—quicker daily commutes, less traffic congestion, and cleaner air around the world. Uber Elevate has already started exploring the barriers we’ll need to overcome to make this a reality.”



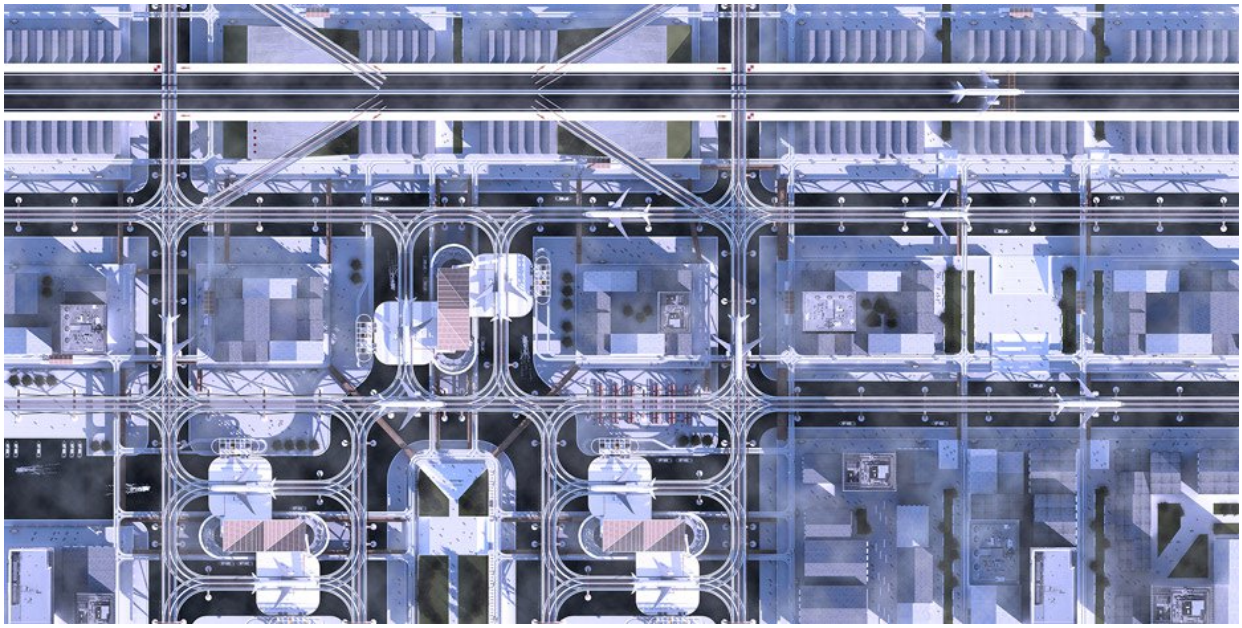
Appendix 4: Corgan's Dalian New Airport Design Competition

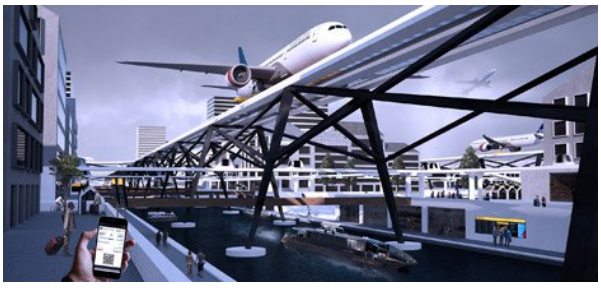
7,300,000 SF, 101-gate terminal, a ground transportation center and "air-city" on an island.

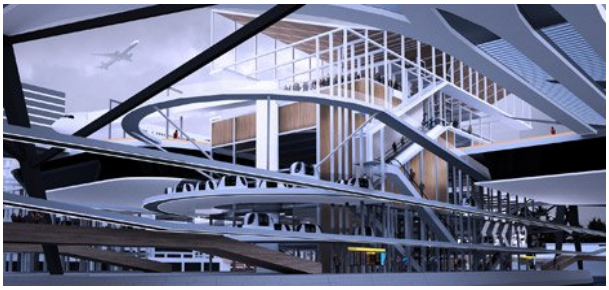
"An international competition launched in July 2014 to design a new airport in Dalian, China, on the site of a new artificial island that has been under construction for two years. The competition brief called for a 101-gate terminal, a ground transportation center, airfield planning and master planning of an "air-city" development on the island."

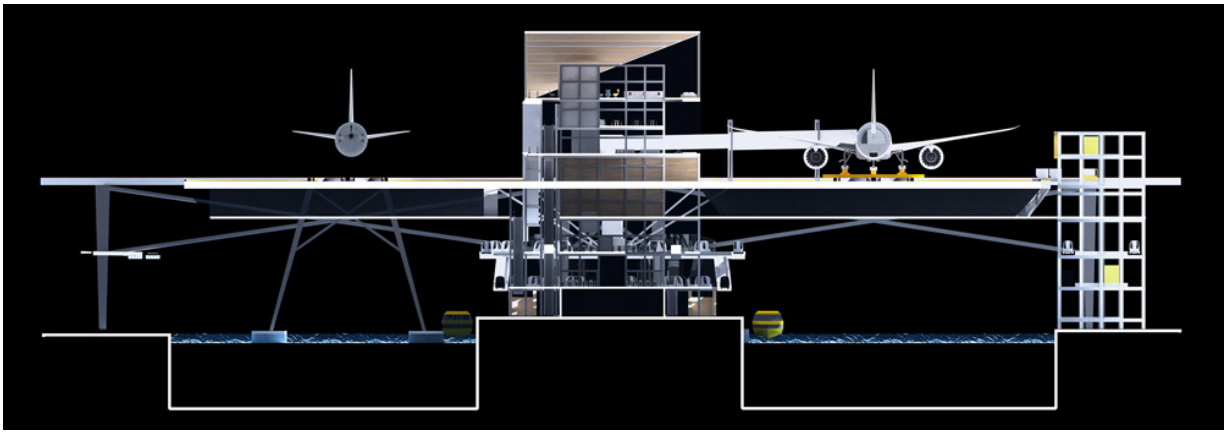
Appendix 5: Sotckholm Elevated Airport Runways

Conceptual proposal by Bartlett School of Architecture graduate, Alex Sutton.









[1] "Can an Airline Take the Stress Out of Travel." *The New York Times*, 4 Oct. 2017, Web.

[2] Schaberg, Christopher. *The End of Airports*. Bloomsbury Academic, 2016,

Assesses current airport conditions, and discusses commercial flight's settlement into the mundane, ongoing present. "We no longer expect romantic experiences or sublime views, but just hope that we get from here to there with minimal hassle;" this brings importance to the future of air terminal design.

[3] "GDP (Current US$)." *GDP Data*, The World Bank, 2017, Web,

Projected 2017 & 2022 GDP data by country, surmising total market value of all final goods and services produced in a given year. Gross world product of 2017 is estimated $77.99 trillion, less than 0.1% of that total is produced by aviation industry.

[4] "Boeing bets big on flying taxis and pilotless planes." *CNNMoney*, 5 Oct. 2017, Web.

[5] "Terminus in Latin." *Glosbe*, 12 Nov. 2017, Web.

[6] Schwieterman, Joseph P. *Terminal town: an illustrated guide to Chicago's airports, bus depots, train stations, and steamship landings 1939-Present*. Lake Forest College Press, 2014,

Basis of defining termini typologies and systems in modern cities. Chicago as an example of urban planning, transit and modern architecture, serves as a western prototype of forward thinking systems. Schwieterman focuses primarily on facilities' transit ideals, implementations and purposes with intentional brevity to design and current functionality.

[9] Easterling, Keller. "Glossary Uber," *Art Papers*, 29, Nov. 2017, Web,

Defining rideshare as a movement and as a creation of technology and culture. Easterling addresses the undertone of the disruptive system as it relates to cities, generational context and economic globalization.

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Sprawl Hits the Wall assesses the conditions of Los Angeles in particular as a city that informs and predicts the wellness of our urban future. What happens in the context of LA affects the turn of events throughout the world, just as global events have an impact on LA's neighborhoods. The report tackles tough challenges and choices, which are spelled out very directly throughout its pages. Ultimately the findings elude to the need to grow smarter, grow together, grow greener, and grow more civic-mindedly.

[17] Hirsh, Max. *Airport Urbanism: infrastructure and mobility in Asia*. University of Minnesota Press, 2016,

This is a unique study of airport infrastructure in five Asian cities—Bangkok, Hong Kong, Shenzhen, Kuala Lumpur, and Singapore. He discusses physical mobility just as much as social immobility linked to modern terminal design, border control facilities, restricted zones, and rapidly developed capacity-struck Asian-urbanism.

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[21] Cordova, Sergio Fernandez de. “Smart Cities are Changing.” *The Huffington Post,* 5 Jan. 2018, Web.

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[24] “Types of Grid System Useful for Layout Making,” *Graphic Institute, ADMEC Multimedia Group*, Jan. 2014, Web.

[25] *Intelligent Transportation Systems - About ITS*, www.its.dot.gov/about.htm, Web.

[26] Benjamin, Walter. "On Some Motifs in Baudelaire" and other selections. 22–40. In Neil Leach, ed. *Rethinking Architecture*. New York: Routledge, 1997.

[27] Baudelaire, Charles. *Fleurs de Mal*. Josef Nygrin, translated by David Paul, 1955.

[28] Clemente, Maria, East, R., Hammond, K., Lomax, W. “The measurement of cannibalization.” *Journal of Product & Brand Management*, Vol. 6 No. 1, 1997, Web.

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Hybrid Air Vehicles is a company that designs and builds airlanders, starting with CAD designs, making small scale demonstrators and then furthering wind tunnel and computational fluid dynamic testing to ensure in optimal designs. HAV is a privately run UK company dedicated to designing one of the lowest-carbon emissions aircraft in the world with game changing endurance, lower delivery cost, and land-anywhere capability.

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“Competition Brief: Airport of the Future” *Fentress Global Challenge*, Fentress Architects, 2017, Web,

Fentress Architects is a global design firm that passionately pursues the creation of sustainable and iconic architecture. Fentress is internationally known for innovative, award-winning design of airports including Denver International Airport.

“DLC New Airport Design Competition.” *Dalian International Airport*, Corgan, 2017, Web,

Corgan is a leading architecture and design firm with a human-centered approach. Corgan has substantial experience with airport operators, airlines, aviation facilities and other air transit organizations.

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Flyshare 2020