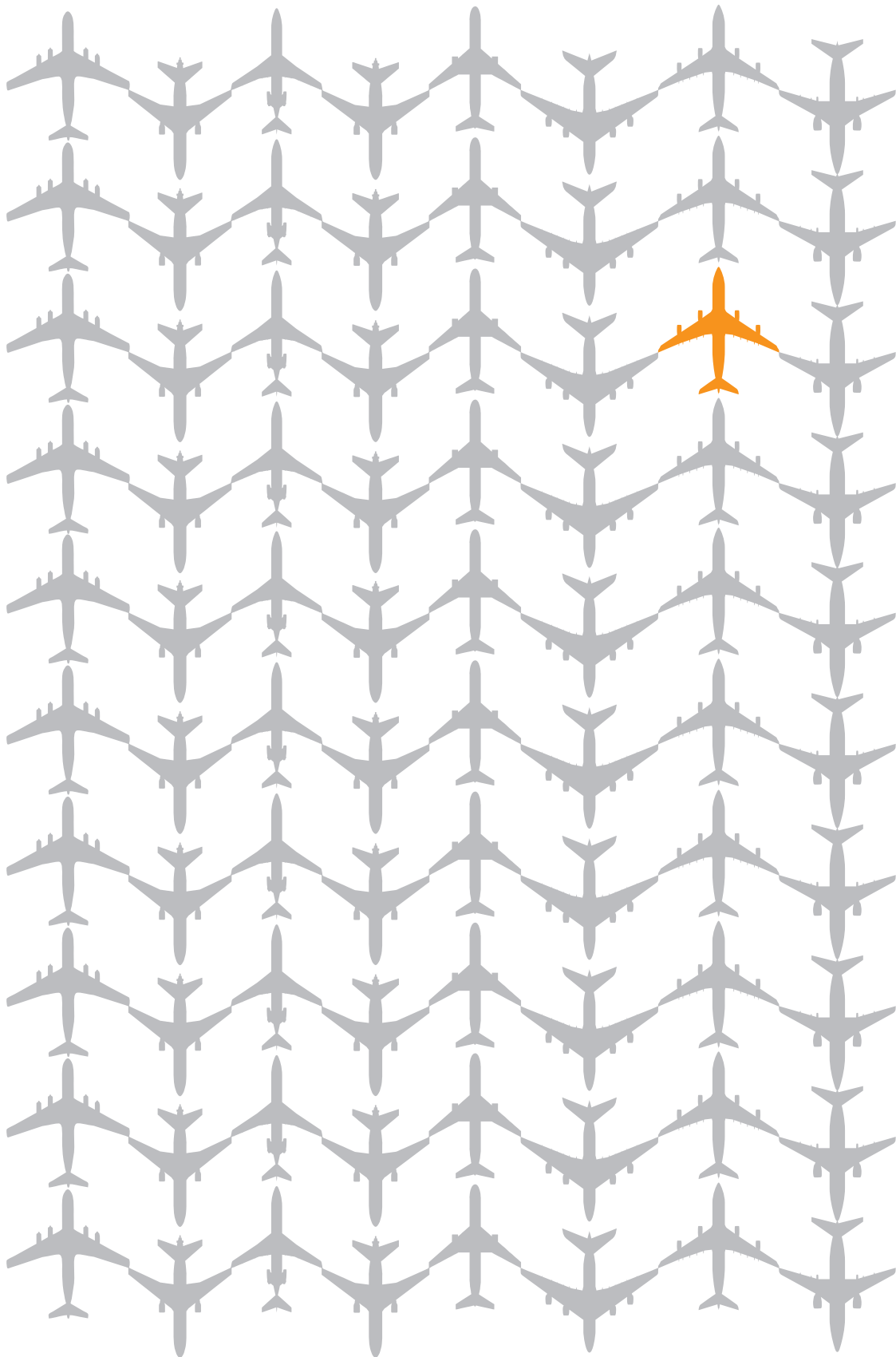
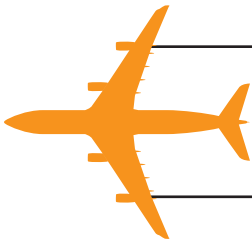


# REDESIGNING THE PASSENGER EXPERIENCE

WITHIN THE CONTEXT OF COMMERCIAL AVIATION:

## DOOR TO DOOR







# Redesigning the Passenger Experience Within the Context of Commercial Aviation: Door to Door

A Design Thesis Submitted to the  
Department of Architecture and Landscape Architecture  
of North Dakota State University

By  
Mitchell Musel

In Partial Fulfillment of the Requirements  
for the Degree of  
Master of Architecture

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Primary Thesis Advisor

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Thesis Committee Chair

Fall Semester 2019  
Fargo, North Dakota

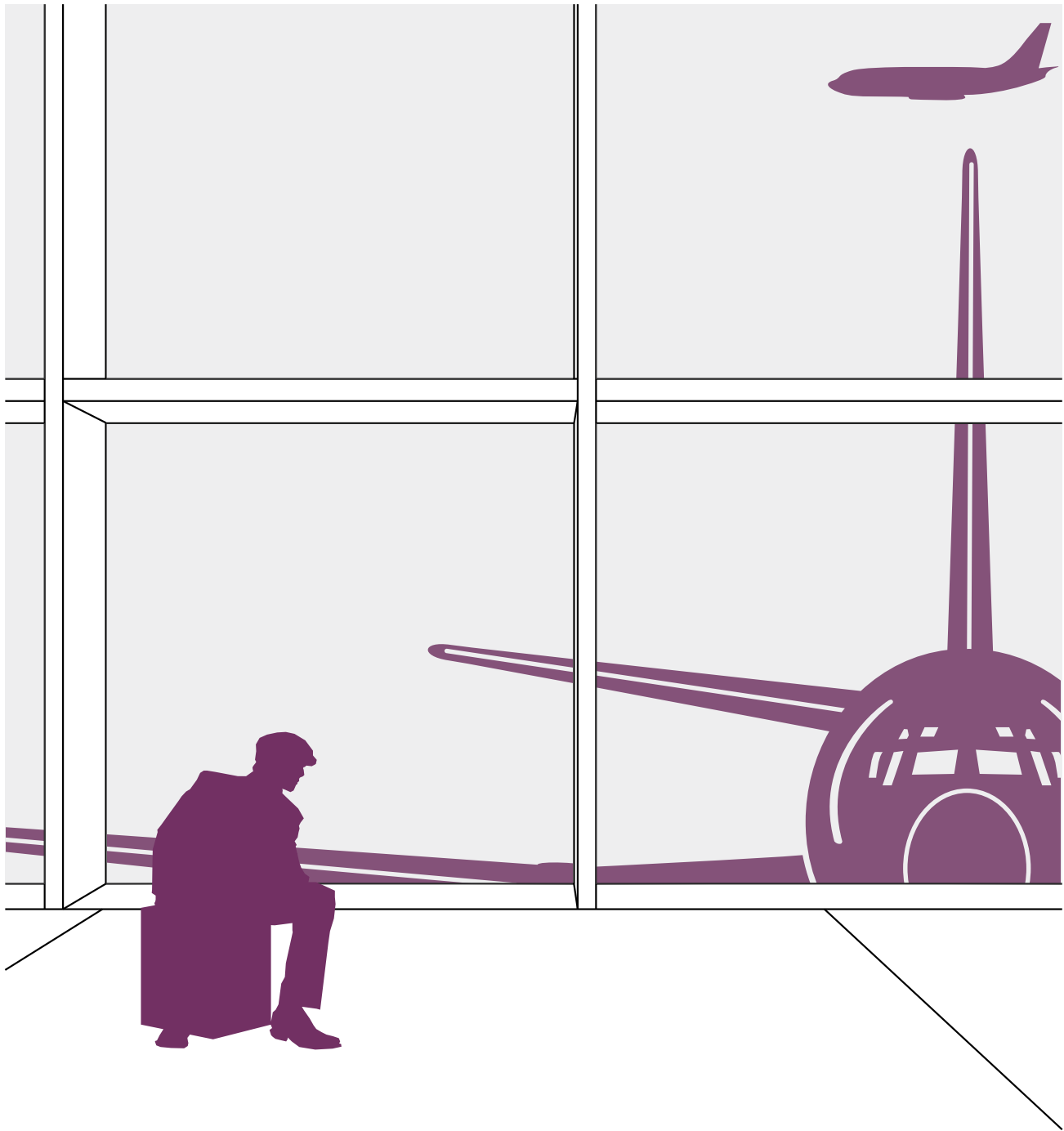


Figure 1 | Waiting Passenger Illustration

# TABLE OF CONTENTS

Table of Contents	5
List of Tables & Figures	7
Thesis Abstract	9
The Narrative of the Theoretical Aspect of the Thesis	11
Project Typology	15
Major Project Elements	17
User Description	18
Site Information	20
Project Emphasis	22
Goals of the Thesis Project	25
Plan for Proceeding	27
Definition of Research Methodology	28
Documentation for the Design Process	29
Thesis Project Schedule	31
Results from theoretical Premise	33
Literature Review	35
Results from Literature review	53
Typological Research	57
Project Justification	64
Site Analysis Photos	68
Program Adjacency Matrix	75
Thesis Appendix	76
Personal Identification	78
Previous Studio Experience	79



# LIST OF TABLES & FIGURES

Figure 1	Waiting Passenger Illustration	4
Figure 2	Wayfinding Passenger Illustration	10
Figure 3	Typology Icons	14
Figure 4	Solo Passenger Illustration	16
Figure 5	User Icons	18
Figure 6	User Profile Radar Chart	19
Figure 7	SEA Aerial Photo   Credit Google Earth	20
Figure 8	Annual Passenger Totals Graph	23
Figure 9	Sky Needle Silhouette	24
Figure 10	Semester Schedule	31
Figure 11	APEX V 7.2 Magazine Cover	34
Figure 12	APEX V 6.2 Magazine Cover	36
Figure 13	Embedded Console   APEX V-6.2, P. 51	38
Figure 14	New Chair Design   APEX V-6.2, P. 31	40
Figure 15	Class Concepts   APEX V-6.2, P. 55	42
Figure 16	Class Concepts Samples   APEX V-6.2, P. 58-62	44
Figure 17	Class Concepts Sample   APEX V-6.2, P. 66	46
Figure 18	APEX V-6.5 Magazine Cover	48
Figure 19	Baggage's Baggage   APEX V-6.5, P. 66	50
Figure 20	ATL Aerial Photo   Credit Jose Ramos	58
Figure 21	ORD Aerial Photo   Credit Skytamer	60
Figure 22	LHR Aerial Photo   Credit Climate ADAPT	62
Figure 23	Site Analysis	68
Figure 24	Site Analysis	69
Figure 25	Site Analysis	70
Figure 26	Site Analysis	71
Figure 27	Site Analysis	72
Figure 28	Site Analysis	73
Figure 29	Program Adjacency Matrix	74
Figure 30	Personal Identification	112



## THESIS ABSTRACT:

When addressing the topic of travel, a series of mixed emotions can rise up within us. Stemming from our experience from previous trips, we may choose to see the entire trip as a positive or negative based upon a single element: air travel. I am to improve the overall perception of air travel by redesigning the passenger experience in the context of commercial aviation: door to door. What this means is that I plan to investigate and improve the expedience and convenience for the passenger when navigating to, through, and from the realm of travel via means of passenger aircraft. Rather than just focusing on improving the airport, I want to encapsulate the entire experience; from the second you leave your home to the moment you arrive at your destination. This stretches across a broad array of factors to consider, such as luggage transportation, accommodation/reservation management, as well as the atmosphere for the passenger in flight, just to name a few. As a result, I aim to create a new network of systems that is integrated cohesively to one another to focus not on the amount of money to be made, but rather on the betterment of the entire air travel passenger experience.



Figure 2 | Wayfinding Passenger Illustration



# THE NARRATIVE OF THE THEORETICAL ASPECT OF THE THESIS

With the rise in modern technology's ability to streamline processes for higher profits, the user experience takes a back seat to the importance of cost. I worry that the attention given to the needs and wants of the passenger have shrunk in the wake of engineering the most economically efficient process possible. The paradigm of getting the highest number of passengers on the fewest number of flights has created language similar to that of shipping cargo; treating people as a product to be moved as quickly and cheaply as possible to maximize the dollars collected by the commercial providers. I aim to bring light to this issue and to look further into the causes and effects of how we can ask more of our travel providers, raising awareness and demand for a passenger-focused travel experience.

When approaching the totality of the passenger experience, I wanted to look at entire vehicular transport from door to door. Centrally this would mean a heightened focus on the airport and aircraft; but I will be looking at the support types of transport as well. This means the areas of connection between home to initial airport, as well as the transit between landing airport and the passenger's destination. This adds a level of complexity to the building typology that I will be researching, as I will be looking at personal automotive travel, public transit (train and bus), as well as commercial transit providers. These secondary means of transit will be merely to understand how the passenger gets to-and-from the airports but will be factors in shaping my understanding of the passenger experience.

When addressing the airport and aircraft travel, it is important to understand their background. This not only helps understand where they've been but have a better grasp of where they're going. The model of the airport has not always been so clearly defined or universally understood. What started as aerodromes (location from which aircraft flight takes place), was merely a place that aircraft of the sky could take off and land as a means of recreation or sport. The term airport establishes the evolution in sophistication, meeting certain certification criteria or regulatory requirements that not all aerodromes may have achieved. In short, all airports are aerodromes but not all aerodromes can be airports. Some of these criteria include landing areas, such as runways to take off, or helipads for helicopters; also common were the control towers, hangars, terminals. Larger facilities may have airport aprons, taxiway bridges, air traffic control centers, passenger facilities (restaurants and lounges), and emergency services to name the most prominent pieces. Integrated into these super structures that are growing both in physical footprint and social popularity, there also lies a myriad of security and logistic systems to ensure the expediency and safety of the passenger. Or so one would think.

I am not challenging the need for security system within airline travel, as this is a crucial piece in ensuring the future perception of commercial airline travel. If people don't feel safe using a service, the service will have to adapt to the needs of the intended client or fail altogether. The issue that I want to address is the way in which



# THE NARRATIVE OF THE THEORETICAL ASPECT OF THE THESIS (CONTINUED)

the passenger's experience has taken a backseat to concerns of financial gain and system optimization. What I'm striving to do is bolster the importance of the user in a system-dominant industry. Not only will this project look at the impact of commercial airline travel, but also the supporting means of transportation that begin and end the totality of the typical passenger's voyage. This means looking at how the user gets ready for the trip, gets to the airport, navigates the airport, and the same elements of reverse order at the tail end of the trip (airport, transit and arrival at the destination).

This type of research is important for a multitude of reasons, but first and foremost: the need for a series of services and industries to realign their values with that of their user, thus creating the ideal passenger experience. The information I'm striving to collect is something that I believe can be used, not only within the confines of commercial air travel, but across similar fields and industries as well. This data will help call out the issues and flaws of the existing traveler processing norms, as well as develop a new standard for which travelers can compare their treatment and experience in what is, ultimately, one of the largest revenue generating services in the world. The idea that airline travel is something that is endured rather than celebrated, that security was a hassle rather than an assurance factor, that getting to where you're going is something that you have to put up with rather than something you can look forward to; this is why I want to create a shift in the perception of how we view commercial air travel, both as passengers and designers of the future.

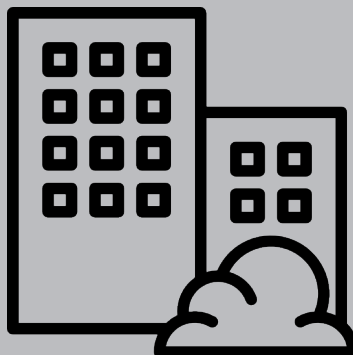
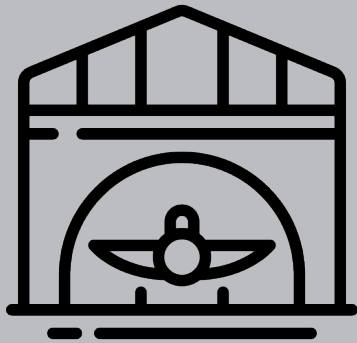
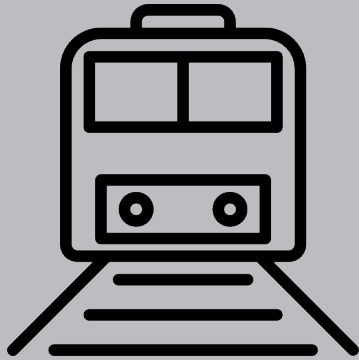
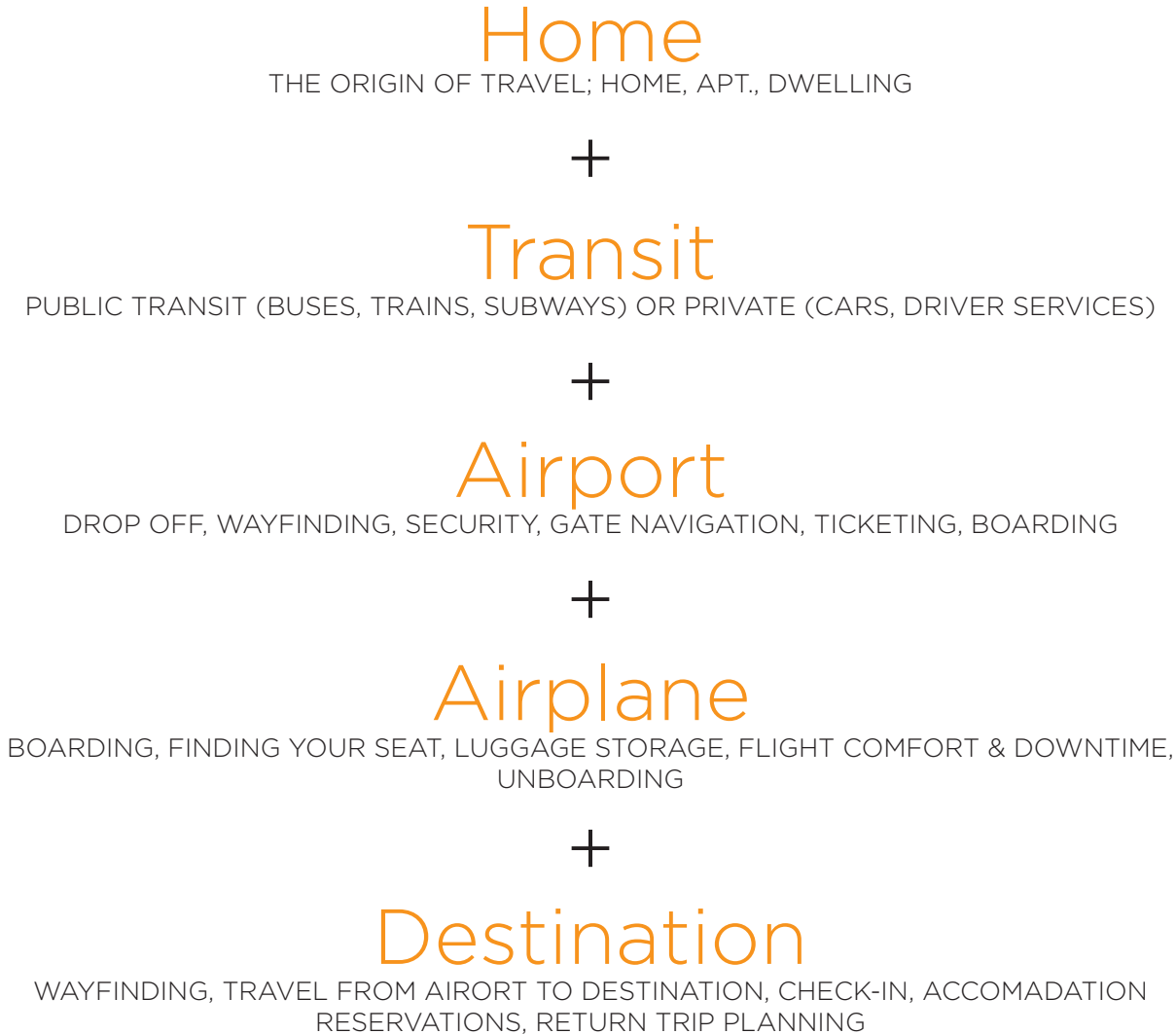


Figure 3 | Typology Icons

# PROJECT TYPOLOGY:

The proposed design will be a system that works with the existing built environment to improve user ease, convenience and efficiency. Areas of interest will include:



Each of these components will be effected by my design, creating a more user friendly system that utilizes existing where it can, and improving where necessary.

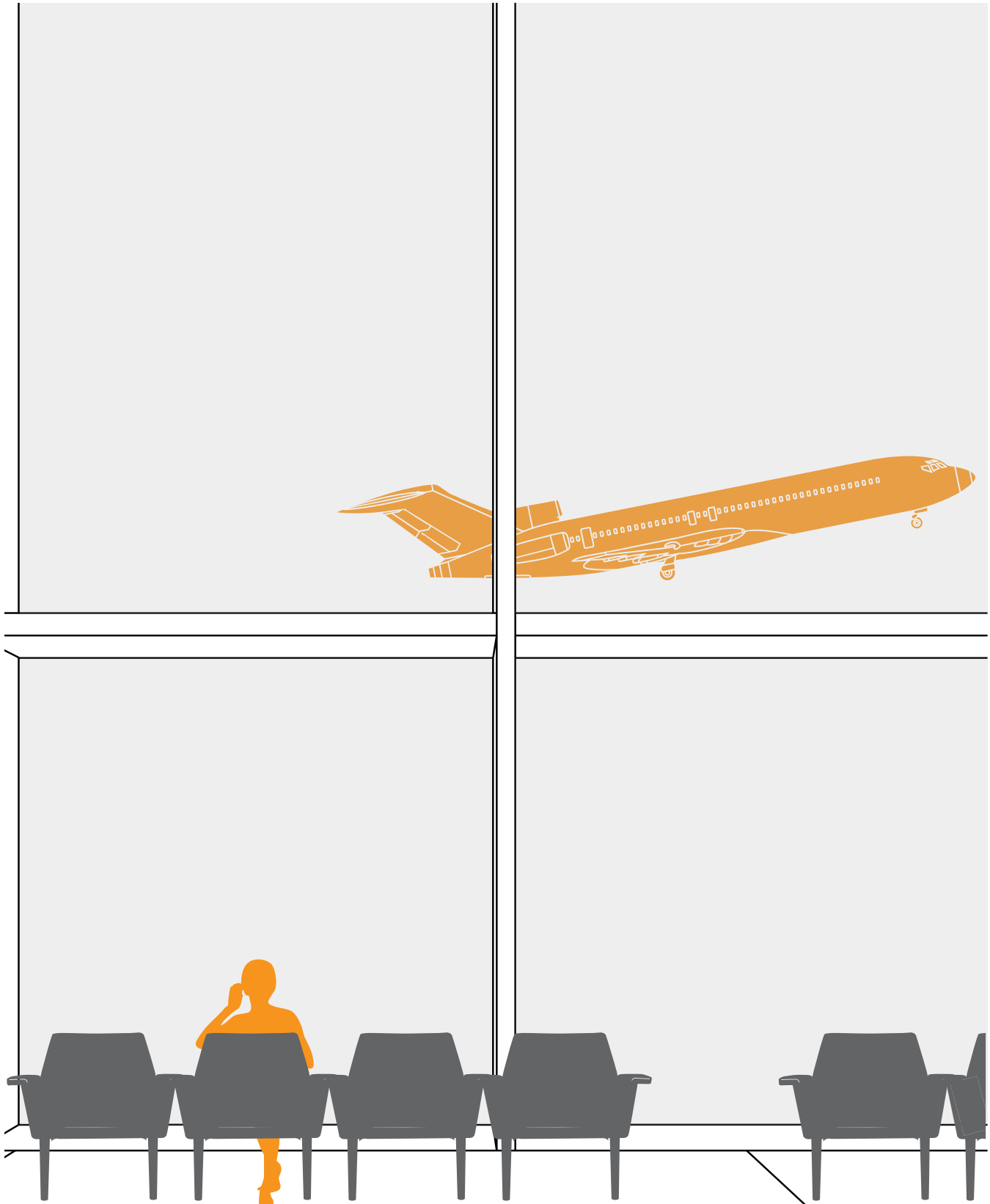


Figure 4 | Solo Passenger Illustration

## MAJOR PROJECT ELEMENTS:

Since this project bridges the gap between architecture and industrial design to some degree, there will be several collections of major project elements according to which stage or location in the travel timeline they occur. With the largest of these locations being the airport, it will contain the largest set of project elements regarding required spaces. This non-exhaustive list includes drop-off location, bus stop, train or rail station, circulation to main ticketing floor, ticketing kiosks and counters, baggage drop, luggage handling, luggage cart storage, restrooms, customer service counters, security screening stations, queuing space, security offices, recomposing space, concourse walkways, food and retail vendor spaces, facilities storage rooms, rest areas, terminal gates, gate hold areas, ground crew lounges, air crew lounges, mechanical repair spaces, trash collection and vehicle storage areas.

Within the airplane major project elements would include the pilot's cockpit and lavatory, flight crew prep space and storage, passenger restroom, beverage/snack cart storage, meal prep space, first class passenger cabin, business/premium class cabin, economy/coach class, secondary flight attendant area, storage spaces, refrigerator, flight commodity storage, overhead luggage bin space, checked bag storage below the plane, and a network of mechanical and electrical components hidden within the framework of the airplane chassis.

## USER DESCRIPTION:



### Vacationer / Tourists

Using travel as a means of exploring new cultures and regions of the world, this user type aims to bridge the familiar with the foreign.



### Business Person

Traveling as out of a means of necessity for commerce, this user type represents the most utility focused group where speed and reliability are paramount.



### Weekend Traveler

As the short-term getaway seeker, this user type uses whatever short breaks available to travel and explore their personal desires.



### Families / Groups

Larger numbers means more items to keep track of, plan for, and cater to. This user type is the largest unit of the four and create an interesting set of needs to be met in the context of commercial aviation.

Figure 5 | User Icons



The chart below was used to better understand the severity of needs of the various different user types. The categories were chosen as likely actions that would showcase both similarities and differences between users will aid in consideration of my design decisions. Values shown in this chart are based on my own personal beliefs per research of different traveler types.

### User Need Profiles:

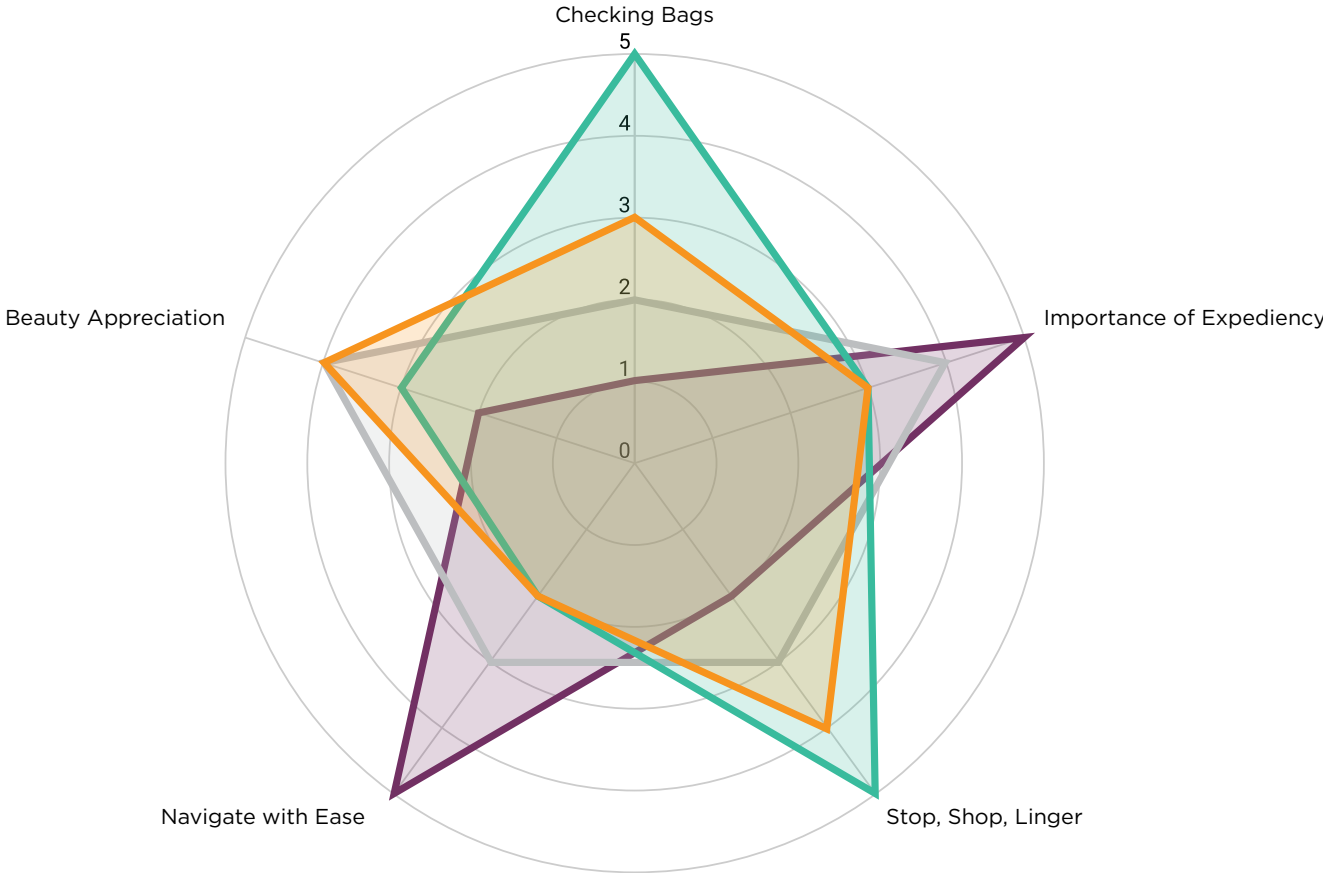


Figure 6 | User Profile Radar Chart

## SITE INFORMATION:

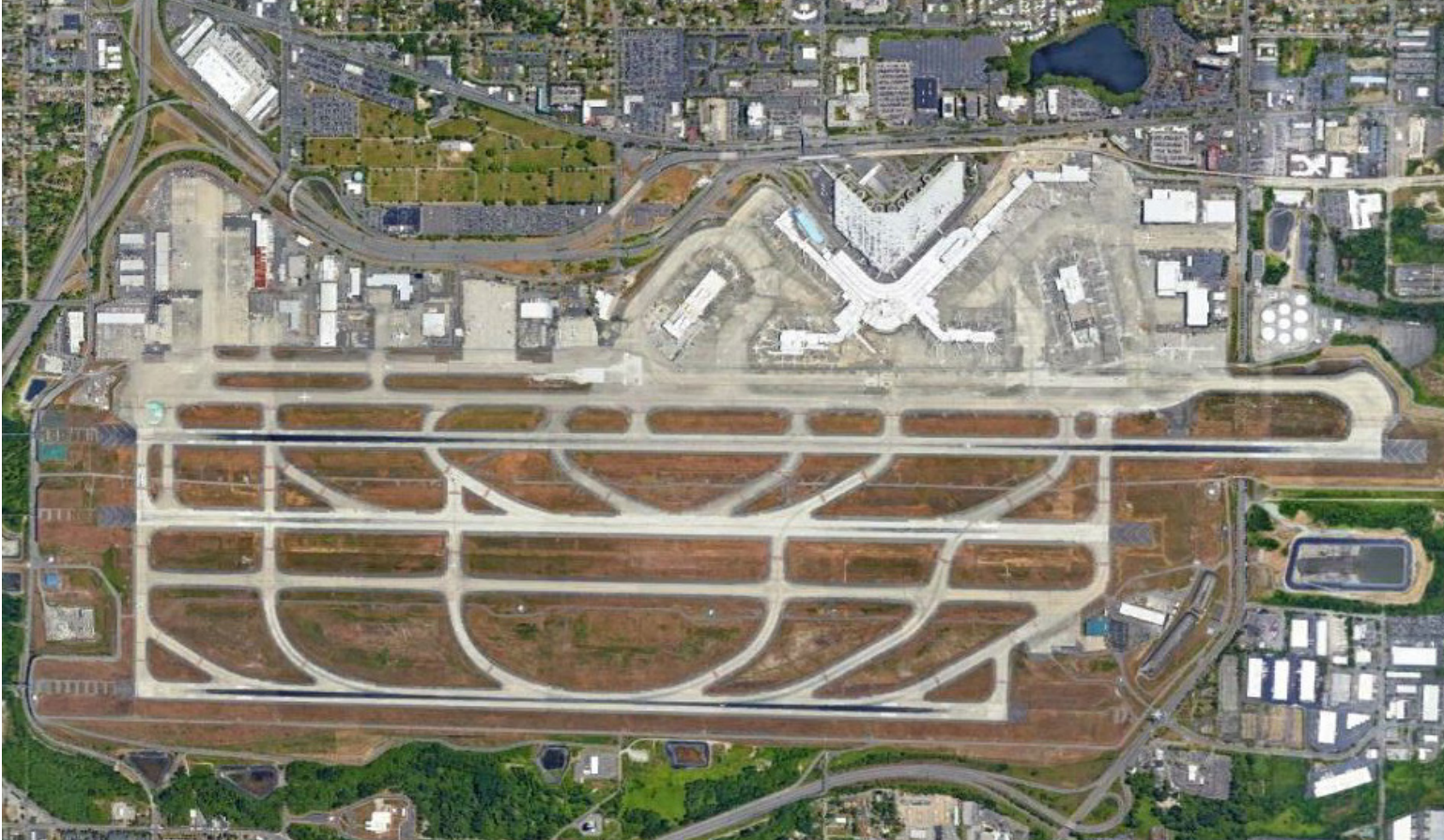


Figure 7 | SEA Aerial Photo | Credit Google Earth

AIRPORT RANKING (PASSENGER COUNT): #8 in USA - #29 in World

AREA (ACRES): 2,500

RUNWAYS: 3

GATES: 80

PASSENGERS : 49,849,520

PARKING: 12,100

The site chosen for this thesis project located in the state of Washington is the Seattle-Tacoma International Airport, or Sea-Tac for short. This airport was chosen based upon its rank and growth as one of the top 30 international airports in the United States. Sea-Tac ranked #8 in the US based upon total enplanement of passengers; over 24 million in 2018. This number has steadily grown at a constant rate, seeing a 3.4% increase from 2016 to 2017 and a jump of 9.9% going into 2018. This rate of increased passenger traffic was only exceeded by one airport in rate of sustained growth per year – FLL, or Fort Lauderdale-Hollywood International Airport in Fort Lauderdale, Florida. This high rate of growth generated interest in how this airport handled such high capacity of passengers on its relatively small footprint.

Sea-Tac rests between Seattle and Tacoma, some of the largest cities in the Pacific Northwest. This large hub of shipping, trade goods, tourism, and major industry centers for engineering and technology companies has drawn crowds from both the domestic and international audience. Seattle, the larger of the two neighboring cities, claims most business that comes through Sea-Tac. With a population of 3.94 million and growing in its metro area, it ranks as the 15th largest city in the US. As a major gateway for trade with Asia as one of its main suppliers, it holds the 4th largest port in North America. The community has developed into a very diverse composition as well; Scandinavian, Native American, Asian American, and African American are a few of major demographics that create the rich cultural diversity that this city provides.

Sea-Tac is located in the industrial district between Seattle and Tacoma, providing the space to handle such high air traffic without having to navigate flight paths directly over the city centers, as well as isolating excess noise pollution by pulling the airport to the edges of each city. Domestic flights account for 89% of all passengers that pass through Sea-Tac while supporting 11% of international flights from its ideal location on the Pacific coastline. With 29 documented international destinations and 91 non-stop domestic destinations, air traffic controllers stay busy to make the most efficient use of its 3 runways. There are 80 gates throughout Sea-Tac and has recently announced that it will be expanding from 85 to 135 airport dining and retail establishments. This growth will provide national brands as well as local favorites a chance to capitalize on the customer base of passengers, staff and air crew that populate its concourses. The airport has one central terminal with 4 attached concourses and 2 satellite concourses that are accessible via bus service or underground light rail.

## PROJECT EMPHASIS:

The project emphasis of this thesis is going to focus on two areas: the passenger hold areas of the airport near the gate, and the seating configuration in how it relates to the airplane frame and chassis. I believe that these two locations hold great potential in how closely related they are to one another that this could be a great moment explore redesigning their relationship to one another. Both spaces offer seating spaces for the passengers, both have spaces that allow for bags and personal items near the passenger, and both are typically oriented in rows or aisles to create some type of order in space.

The act of finding your gate at the airport, checking in at the gate counter, finding a seat to wait for your boarding time- all only to then recollect your belongings, pass through the gate into the jetbridge and repeat the process again of finding your seat, storing your belongings, and settling back into a seat seems like a waste of effort and adds delay and frustration for the passengers during their travel.

I want to explore how the airline industry can explore alternative options that would prevent passengers from performing this repetitive ritual of hurrying to a destination, waiting, sitting, settling, rising and repacking all just to be repeated in a new location in some roundabout way. The passenger is paying a premium for a service that is supposed to cater to allowing their safety, leisure and comfort to take precedence over all else. Perhaps if the same areas that passengers congregate to wait to board their flight suddenly becomes the seat that they're assigned for the flight itself. This would involve some type of mechanical automation of transporting the seated passenger from the hold spaces of the airport directly into the cabin of the aircraft.

This streamlining of operations would eliminate the process of having passenger file in one at a time through a single door; rather, multiple rows, even entire passenger class types could be extracted from the side of the building and mounted onto the chassis of the airplane. This means that passengers could already be seated in their correct location without having to step over other seated passengers with their belongings already stowed away and buckled in before the designated plane arrives to be loaded with its passengers. With the growing customer base of passengers taking to the skies, time is the one commodity that airlines cannot waste if they want to continue to be competitive in the airline industry.

## Annual Passengers Worldwide

1970-2018 with Projection of 2036

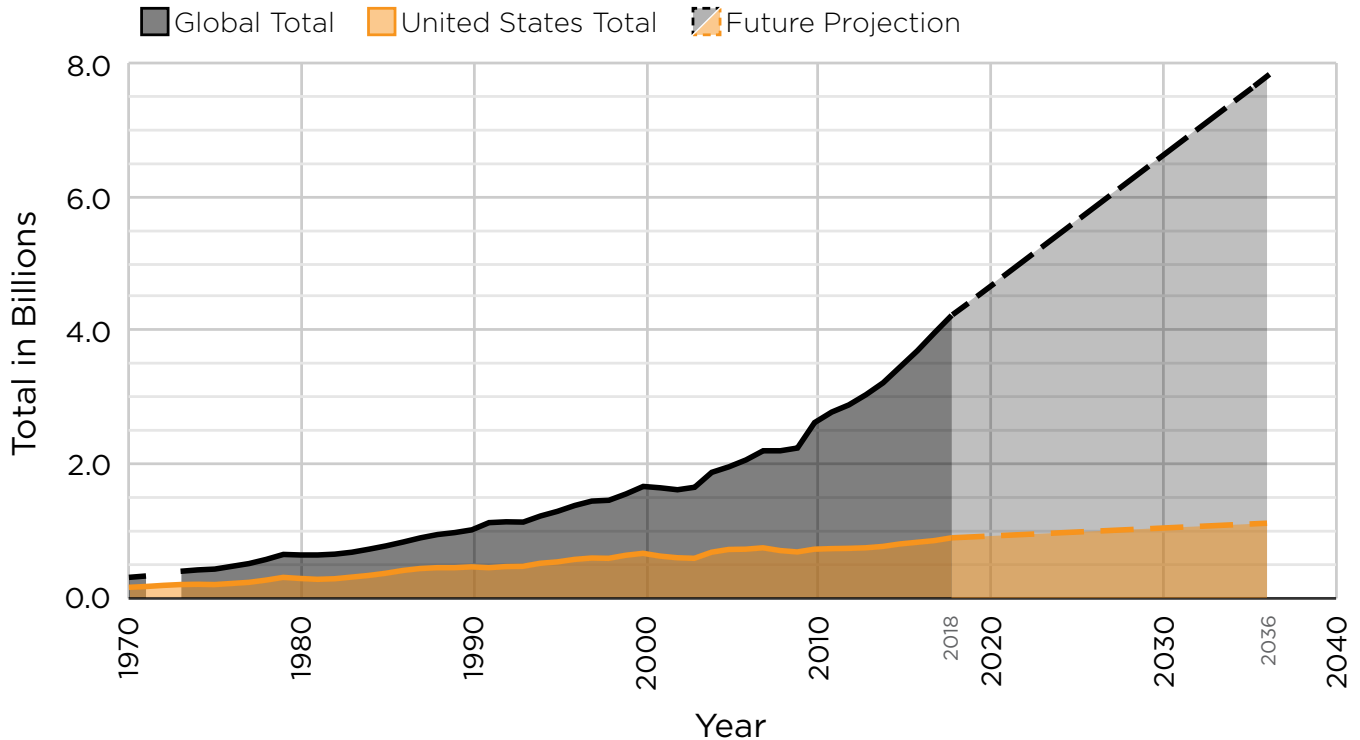


Figure 8 | Annual Passenger Totals Graph

Since IATA began recording data on annual passenger counts in 1970, the numbers have steadily grown year by year. The United States, shown in gold, made up a high percentage of the global total in earlier years; accounting for approximately half of all reported passenger counts up until about the year 2000. This shows the airline industry gaining traction in other countries across the globe, adding their name to the long list of cities in the aviation network. The total passengers reported in the year 2018 reached 4.23 billion people across the world. Research by IATA Data Reports projects that by the year 2036, this number will climb to 7.8 billion. The number of passengers in the United States is forecasted to grow at a much slower rate yet is still projected to reach up to 1.1 billion.

This thesis project would help to better develop a more efficient and enjoyable process of flying on commercial airlines. If the previously mentioned projections come to fruition, the industry must start preparing now to save passengers time and minimize frustration by learning where pitfalls exist in the current system and start preparing proactively.





*Figure 9 | Sky Needle Silhouette*

## GOALS OF THE THESIS PROJECT:

My goals for this thesis project are both qualitative and quantitative as they seek to better utilize quantifiable elements such as money spent or time wasted; I also seek to create something that is not quantifiable, like that of improving the peace of mind of the typical passenger onboard a commercial flight. To better explain these goals, I've broken them down into three categories:

Academically, I hope to learn more about the aviation industry and develop a more keen eye to the ergonomic considerations that go into the design of airports and aircraft alike. This project will foster a deeper consideration for the human scale in the context of the built environment. By studying how airlines have crafted their individual environments for their passengers, I can better learn from the difference between what makes a good environment and what can make it even better.

Professionally, this type of research into the airline industry will help showcase my ability to create clear, concise ideas from a mass collection of data and reports. My interest in research has aided in better directing what specific areas need the most attention and which details would just serve as supporting information. I would like my process to be showcased in this project, making clear connections between each point of progression from one topic to the next throughout the project. Studying public transportation can benefit me as I move into the professional real, as its lessons can be translated into a myriad of project typologies and areas of future work experience.

Personally, I want to challenge myself to create a project that not only am I proud to showcase to friends and family, but also have hopes to make a lasting impression on those that read and study my thesis development. Creating a new interactive element that pulls elements of architecture, product design, and pieces of ergonomic testing is something that excites me and motivates me to do more. As the pinnacle of my collegiate studies thus far, this thesis should embody all the concurrent knowledge that I've learned over the years into one, cohesive, beautiful final product that I can look back on and always be proud of.





# PLAN FOR PROCEEDING

The process used to arrive at a scientific research conclusion

Upon completion of the proposal and program sections of this thesis project, I will move into the conceptual design phase. Developing a preliminary context model based upon the layout of the Alaska Airlines Terminal of the Sea-Tac Airport will be my first priority. By contacting the airport to request blueprints or any available material they can provide, I will begin to develop the departure level of the Alaska Terminal.

By using software programs like Revit, AutoCAD and Rhino 5.0, I can begin to create an existing model to better study where improvements may be made. This modeling will act as the vehicle in which I plan to develop my conceptual design application. I also plan on developing a model of the aircraft of interest, Boeing 737-800 series. This model will only contain the massing of the plane itself as well as a small portion of the interior spacing fleshed out to better develop my thesis concept design within the airframing component as well.

Several iterations will be tested within the framework of these two context models to further progress into a more efficient, ideal passenger experience. Each iteration will be analyzed to document what showed signs of improvement and which areas need more refinement. Studies of spatial arrangements within the airport will take precedence on the airport side; whereas studies of ergonomic fit and feel within the airport will be the main focus inside the aircraft. Documentation will be cataloged in a progressive series so that the audience may better follow along with visual indicators of where the design has gone. As the iterative process continues, more questions will be answered, better framing the next step in conceptual design of the thesis project.

I will research existing airline interior designs, take note of projected interiors, and draw inspiration from outside industries with related interest, such as automobiles and other vehicular interiors. This broadening of horizons regarding the possibilities of the furnished passenger spaces will only benefit the treatment of the passenger. Using related industries to better understand how like-minded professions design to better accommodate the human body will better train my eye for the design of this thesis as well as a running knowledge of catering to the human scale and its particular needs.

As my research and iterative designs become more clear, I can begin to draft what I believe to be the ideal environment for comfortable, efficient and safe airline travel. By the end of this thesis development, I will have created the new standard of customer satisfaction by having redesigned the passenger experience in the context of commercial aviation: door to door.

# DEFINITION OF RESEARCH METHODOLOGY

The process used to arrive at a scientific research conclusion

## Steps in Development of Research Methodology

*Define the unifying idea*

*Research into explanatory sources about the topic*

*Utilize learned information answer related questions*

*Test ideas and new information learned about the topic*

*Analyze the outcome to develop an informed design options of your own*

*Formulate these options into an applicable intervention*

# DOCUMENTATION FOR THE DESIGN PROCESS

## Documentation compilation

Document creation

## Medium for design investigation

Computer representation

3D Printing

Hand Drawing

Hand Modeling

## Software for Intestigation

Autodesk Revit

Autodesk AutoCAD

Autodesk Infracore

Rhinoceros 5.0

AnyLogic 8.5 Information Simulation Software

## Software for Representation

Adobe InDesign

Adobe Illustrator

Adobe Photoshop

## Design Preservation Efforts

Exploration and documentation of representation styles

Feedback from thesis advisors

Research trends and innovations within related industries

Digital files stored on cloud service & backed up on external hard drive

Weekly log on OneNote of discoveries and breakthroughs

Thesis book updated weekly

## Publication

Relevant material will be recorded and credited in final thesis book

Available in NDSU Institutional Repository and hard cover book format

## Documentation Organization

File Labeling convention:

File Type\_File Name\_M.Musel\_Date Created/Saved

Example: Graphic\_Passenger Silhouette\_M.Musel\_12.8.2019



# THESIS PROJECT SCHEDULE

Fall Semester Schedule

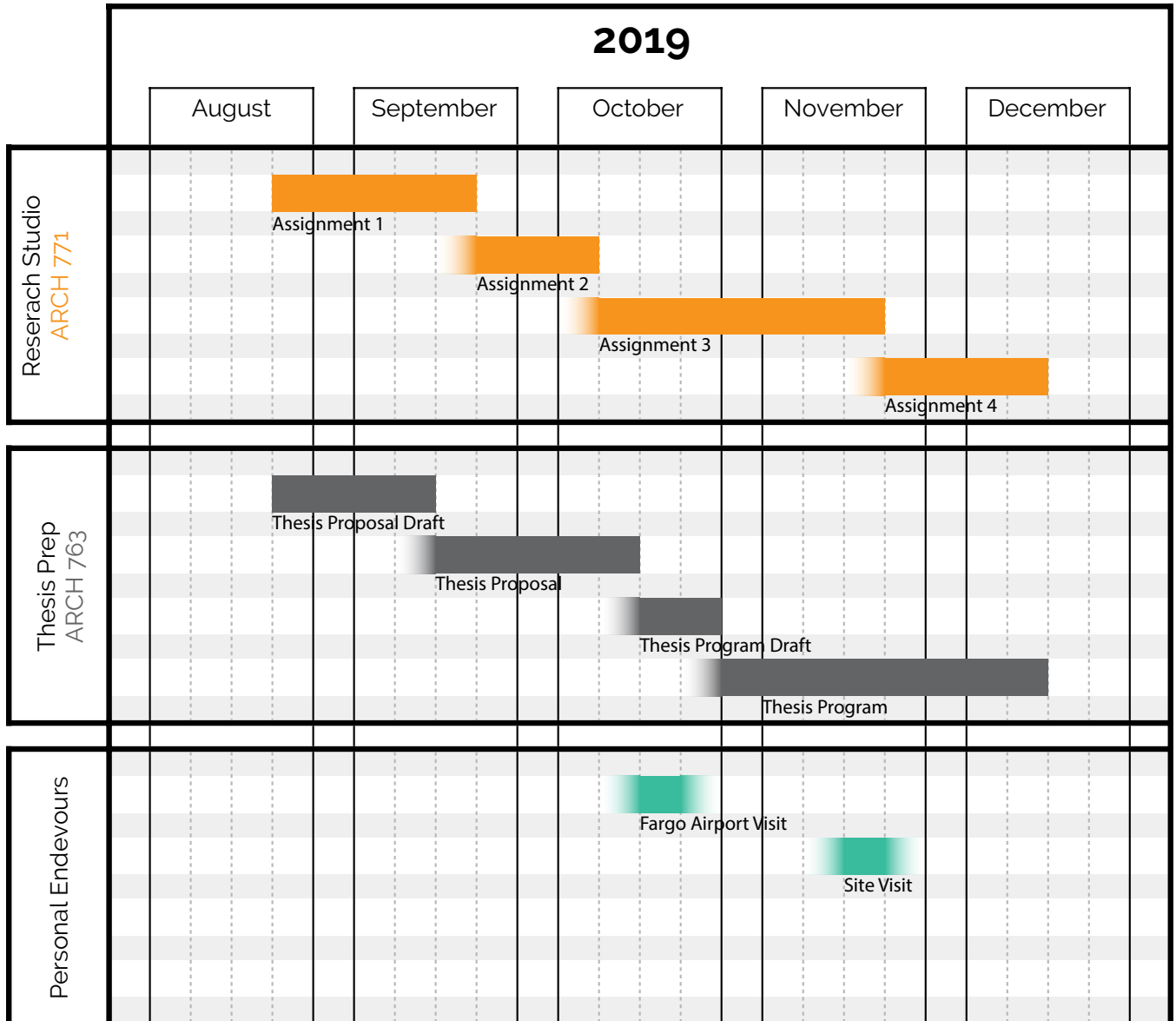


Figure 10 | Semester Schedule



# RESULTS FROM THEORETICAL PREMISE

## Analysis of Industry Trends via Literature Review

Five articles were analyzed from one of the leading magazines in the airline industry: APEX Experience. The Airline Passenger Experience Association (APEX) is a bi-monthly publication that reports on topics within the airline and aviation industry. is the only non-profit membership trade organization comprised of the world's leading airlines, industry suppliers, major media groups and related aviation industry leaders dedicated to elevating the passenger experience for more than 80% of global passengers, while driving industry initiatives and desired regulations. APEX is a network of the world's leading airlines, suppliers and related companies, offering a wide range of opportunities to excel in the airline passenger experience industry by keeping them current with the latest industry news, trends and developments and by helping them develop relationships with clients and colleagues from around the world.

APEX has sustained connections to companies specializing in:

*In-flight Entertainment & Connectivity*

*Catering & In-flight Services*

*Seating & Interiors*

*Lounges and Retail*

*Web Services (including online booking, check-in, website and mobile services)*

*Aviation Technology & Standards*

*Aviation Publishing & Communications*

With all of these closely connected industries and specialists all published under the same organization, APEX became the main publication of interest when discovering trends and forecasts in aviation. Multiple published volumes were sifted through until an article pertaining to my specific thesis topic was discovered. These articles were then analyzed for new, pertinent content and tied back in to relate with my existing research.

AIRLINE PASSENGER

# experience

VOLUME 7, EDITION 2 | APRIL – MAY 2017

## What Is Comfort?

Experts sink into the big question



OFFICIAL PUBLICATION OF THE AIRLINE PASSENGER EXPERIENCE ASSOCIATION



Figure 11 | APEX V 7.2 Magazine Cover



# LITERATURE REVIEW

## “What is Comfort?” by Katie Sehl

APEX Experience - Volume 7, Issue 2

When addressing the topic of passenger comfort, I sought out the thoughts of professionals in the airline industry to get me started on the right track. The article presents the dialogue of several professionals in the airline industry, specifically those who may have control over passenger comfort, in a roundtable setting. The members interviewed for the discussion on comfort were as follows: Tom Eaton, Director of design for LIFT by EnCore. Flavia Renata Dantas Alves Silva Ciaccia, Engineer of comfort and ergonomics working for Embraer. Mark Hiller, the Chief executive officer with Recaro Aircraft Seating. Finally, there is Blake Emery, Director of differentiation strategy for Boeing. These individuals create a diverse network of people that all offer insight on their views on passenger comfort.

The main issue lies in having vast differences in how each user defines comfort. Each of the professionals provided a different variation; one of interest that I liked: “Perceived comfort is in fact always an interaction between two aspects: First, individual preferences associated with convenience and well-being...and secondly, physiological and biomechanical factors,” says Eaton. “Discomfort is more definable, as it presents itself as a clear pain point.” This problem seems to present itself as a moving target, catering the interior of an airliner cabin to please as many of its passengers as possible. When approaching how to design the most comfortable cabin atmosphere, multiple elements had to be considered. Trial and error seemed to be the best method of development. “We learned from this that it is not simply the additional inches that matter, but also the subtle nature of surfaces that define space,” says Ciaccia. One trial showed that the sense of discomfort is reduced when a person is focused on an activity of interest to the individual. This idea holds water since there is a growing use of seat-back screens, or in-flight entertainment (IFE) as they’re called within the industry. We will revisit the topic of seat-back entertainment in a later article in more depth. Service can also play a major role in perceptions of comfort despite having nothing to do with the physical characteristics of a seat. Rude flight attendants and bad hygiene can reduce the comfort experience dramatically. Even flight delays make passengers predisposed to rate their comfort negatively.

Judgement plays a big role in the perception of comfort as well. If something is perceived to look uncomfortable before even being used or sat in, there is a less-likely chance it will be deemed comfortable after use even if it was comfortable in a blind testing. A recent shift in what “comfortable” looks like is occurring. It used to be thick plush cushions, real leather and wood laminates that ruled the world of airline interiors. Modern furniture today relies more on thin, lightweight structures, and smart, often knitted, fabrics that have the ability to morph or comply unexpectedly. A resurgence of Scandinavian-influenced minimalism, made popular by IKEA, has broadened the appeal of functional design.

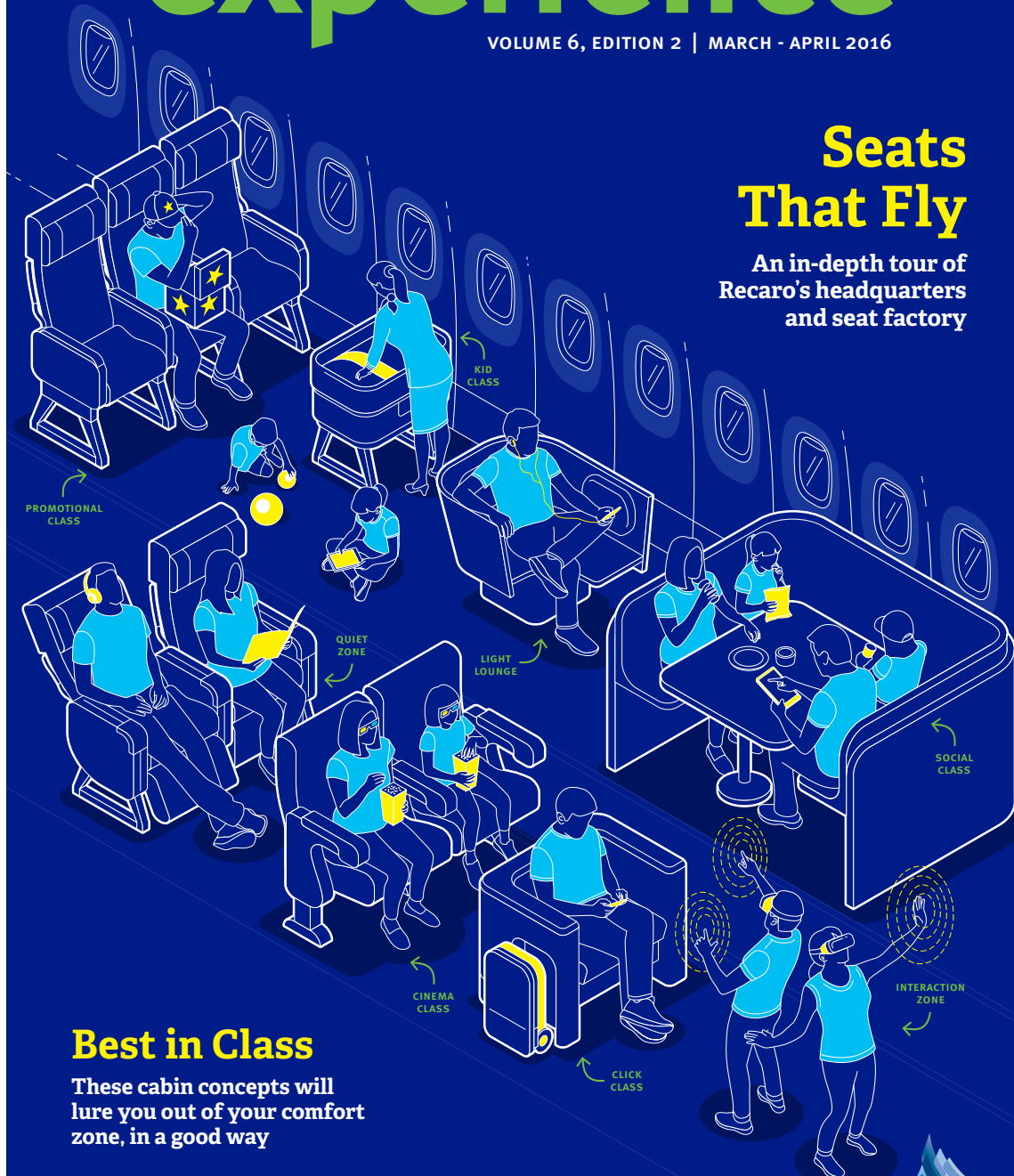
AIRLINE PASSENGER

# experience

VOLUME 6, EDITION 2 | MARCH - APRIL 2016

## Seats That Fly

An in-depth tour of Recaro's headquarters and seat factory



### Best in Class

These cabin concepts will lure you out of your comfort zone, in a good way

OFFICIAL PUBLICATION OF THE AIRLINE PASSENGER EXPERIENCE ASSOCIATION



Figure 12 | APEX V 6.2 Magazine Cover

One case study of changing environments was presented in the article as well. Two aircraft were used in the Norwegian Air Shuttle; one with existing interior and the other outfitted with a new Boeing Sky Interior (BSI). Boeing and the airline used it as an opportunity to test the perception of the passengers. Despite having the exact same seats and the exact same amount of space, passengers reported being more comfortable on BSI-equipped aircraft.

In the end, one conclusion can be made for certain. Comfort is hard to agree upon, but it's the space in between that's the providence of design.



Figure 13 | Embedded Console | APEX V-6.2, P. 51

# LITERATURE REVIEW

## “Embedded Trip Advising” by Damien Caissie

APEX Experience - Volume 6, Issue 2

One of the components that I wanted to learn more about was investigating how airlines are addressing how passengers use their time while aboard their aircraft. As this tends to be the calmest portion of any traveler’s voyage, I wanted to see what kind of consideration went into providing content or services that would better suit the passengers wants and needs.

As a means of better serving the connected passenger, airlines are partnering with travel accommodation services while in flight. As part of Air New Zealand’s seatback entertainment system, TripAdvisor gives passengers the ability to book restaurants, hotels and activities, on the fly. With over five-million-plus business listings reviews and booking platform at passengers’ fingertips, passengers can begin to discover what awaits them before landing, while remaining engaged with both the airline and TripAdvisor’s brand. By targeting content to the flight’s source and destination cities, passengers are provided with information that they can readily relate to and use. This helps bridge the gap between home and the destination.

By implementing this platform built-in to their aircraft, the passengers have access to information at no additional cost that could create a better-informed passenger, clearer navigation upon arrival, even improve peace of mind when entering an alien space. This clever, intentional use of downtime while in the air, in my opinion, is a great way to ease the nerves of the passenger of what happens when they land and creates customer appreciation of the airline for offering such a useful tool onboard.

Next, I want to ‘unpack’ one of the biggest reasons that I sought out improving the passenger experience, and that deals with how the industry addresses passenger belongings.



For more news on seating, visit  
[APEX.AERO/COMFORT](https://www.apex.aero/comfort)



## Comfort With A Twist

With a rib cage-inspired framework, the seat's flexibility is intended to improve passenger comfort in economy class, especially on long-haul flights.

Figure 14 | New Chair Design | APEX V-6.2, P. 31

# LITERATURE REVIEW

## “Comfort with a Twist” by Jenn Wint

APEX Experience - Volume 6, Issue 2

The design of the passenger seat in the economy class has often been a topic of debate when it comes to addressing comfortable design. For ages, the basic elements have remained the same when it comes to the ergonomic fit and feel of the typical airplane seat. Adam White, the director at London-based FactoryDesign, had a realization while on a long-haul flight that the economy class seat needed to be redesigned. From his uncomfortable travels came the idea for the Twister Seat was born.

The concept of the came from the idea that an uncomfortable passenger will twist and turn in their seat while the current seat design doesn't allow for the kind of twist – it more acts like a door hinge, fixed and rigid in its directional movement. The Twister Seat would allow for movement, side to side and forward and back, mimicking the natural body movements of the rib cage. The Twister seat would allow for movement, side to side and forward and back, mimicking the natural body movements of the rib cage. Would be similar in weight and dimensions of current standard economy seats. Comfort was the primary focus, but it had secondary benefits as well. The seat accommodates the intimacy of conversation. Otherwise, you can twist away from the person next to you for a feeling of more privacy. Their new seat pan would also prevent pressure points on the bottoms of passenger's legs, showing a significant drop in stress in this area during trials of testing. “Economy doesn't feel as healthy as it should,” White says. He's also optimistic it is set to improve.

My impression of this document set to mimic the body in order to better accommodate the body is a very exciting direction. The need to follow the standard of all previous airline seats. Not only would this new design develop a new model for rethinking how the ergonomics of a seat can affect the physical wellbeing of the passenger, but it can also play a role in the social impact of the travelers' interactions. By allowing the seat to move more like that of the body, the design is made like a body, for the body. The idea of creating a more user-friendly environment by using the passenger as the inspiration is something that excites me to see what other areas may be adapted to the betterment of the passenger.

On the topic of seat design, the next reading I found tied in nicely to the same platform for passenger entertainment and provided amenities.







# LITERATURE REVIEW

## “Class Concepts” by Caroline Ku & Katie Sehl

APEX Experience - Volume 6, Issue 2

A new wave of class concepts is rocking the cabin, promising a total overhaul of traditional three-class configurations. Ku and Sehl had a chance to sit down with airline officials and progressive air framers to talk about what was on the drawing boards for approaching a redesign of the passenger cabin experience.

### 1. Light Lounge:

A phrase borrowed from urban architects that describes planning around the paths and movements people are naturally inclined to choose. Letting the passenger decide where they want to sit and move is something that could not happen in the traditional rowed seating system. People want to be where the light is. The design places the corridor in the middle and encourages passengers to gravitate towards the windows along the edges of the plane. It is said to have taken some inspiration from train travel configuration.

Light is one of the three factors that aids in your circadian clock, the other two temperature and food. Yet light is the most important of the three. It has proven effects to even help with jet lag for the frequent or long-haul traveler. This lounge style could increase ancillary revenue as well by offering self-service snack and beverage stations. Designers even say it would expediate boarding by streamlining people through a dedicated corridor, which I’m sure most passengers would appreciate if it were proven to be effective.

### 2. Social Class:

With “Swanky 1970s-era lounges” inspiration, this design would have designated areas for socializing in the cabin that airframers, airlines and manufacturers are excited about. There is some apprehension, as socializing during public transit is typically avoided or frowned upon. Yet these blended-space areas would bridge the gap between classes, with seating configurations ranging from booths to bookable bars and chef’s tables. Flat surfaces that passengers can utilize are typically in short supply in the modern aircraft arrangement. This would offer a table-centered seating area, giving space for activities that can’t be tolerated in current layouts. Family booths allow parents and their children to face each other across a table, defining a space where games can be played, or meals can be shared. Mention of duo-seating would solve the third-wheel problem for honeymooners, replacing the middle seat with a table for champagne, hand holding and privacy among passengers.

### 3. Vitalizing Zone

In anticipation of elderly and female business travelers, theres a push to create health- and relaxation-conscious Vitalizing Zone, which delivers comfort and openness to the flight experience like never before. Mentioned features include observation deck with panoramic views of the skies, holographic shades to control amount of light, humidify the air around you if you’re feeling dehydrated while in flight, and many more. Seats

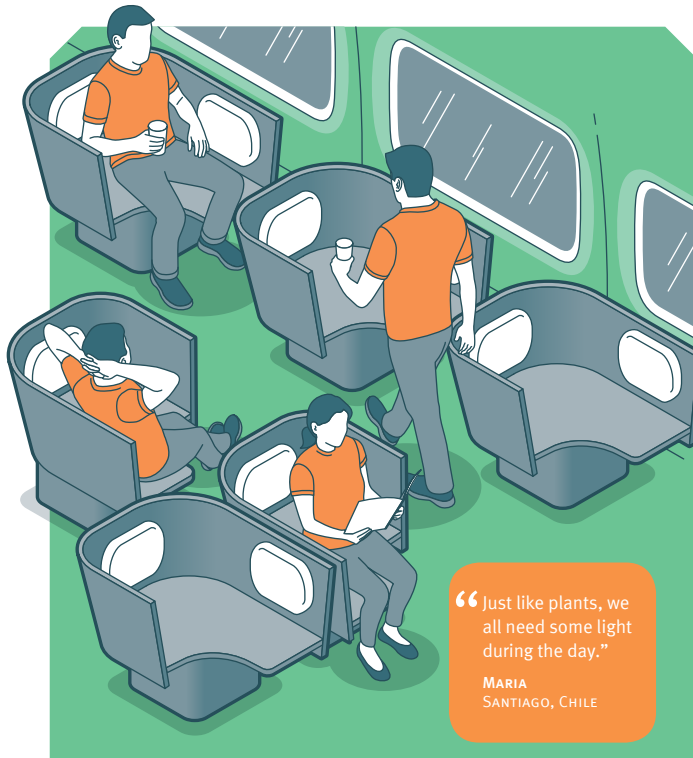


Figure 16 | Class Concepts Samples | APEX V-6.2, P. 58-62

even grow and conform to the shape of the passenger's bodies with smart technology like massages and heating or cooling. "It's no longer just a transportation medium to get you from A to B," says Ian Scoley, head of Industrial Design at Airbus. "It's a lot more about the experience and productivity and well-being of how you use your transportation system. And we're aiming for a cabin that makes you feel healthy when you get off it."

#### 4. Click Class

Mentioned earlier in this literature review, this class offers a new way of looking at how people relate to airlines as more than just a temporary means of transportation. "There's a desire from passengers for airlines to behave as lifestyle brands," says Devin Liddell, principal brand strategist at Teague. This newly created class acknowledges the needs of a more economical business traveler who isn't looking for traditional business-class luxuries; they value the seat-side storage and aisle seat that can keep up with their on-the-go lifestyle. Poppi, Teague's dream airline, beats disruptive startups like Dufl and AirPortr (commercial groups targeting business grade bags and system integration with airlines) to the race by delivering passengers' bags to their hotels or alternative accommodations, offering travel without the burden of having your luggage in tow. The concept is that the user would purchase a suitcase that becomes a part of your seat when you book your flight with the same airline. This ensures a deeper commitment of customer loyalty by having the passenger buy-in on purchasing the suitcase.

#### 5. Kid Class

As a means of creating space for kids while there are so many public areas that have kid-free zones, Kid Class would provide an area specifically for kids and parents alike for play and interaction during the flight. Partnered with this would be a nanny service to watch over kids in this zone during the flight should the parent or guardian want rest or need to tend to business during the flight.

#### 6. Quiet Zone

This zone seems self-explanatory and would be dedicated strictly to adults. The challenge exists on of how to cancel all unwanted noise without full control of the other zones of the airplane. This class could be laid out much like the current typical commercial aircraft, only the social requirement of being silent in this zone would be applied.

#### 7. Sleeper Class

Targeted at long-haul or overnight passengers, this concept of being able to book a bed in a private room of a boutique hotel-style with all the same amenities seems like a dream. It would provide an alternative use of left-over cargo space by installing sleeping berths in for the passengers' use. Some early schematic designs

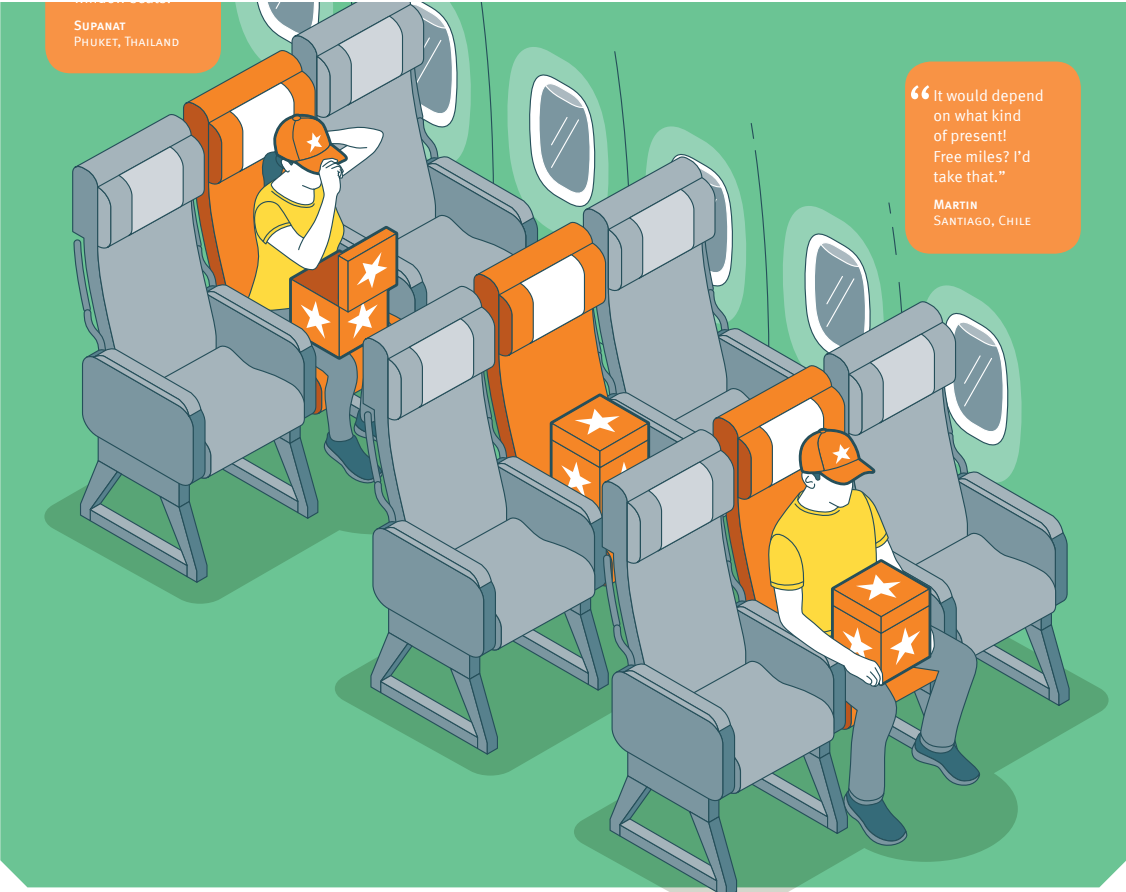


Figure 17 | Class Concepts Sample | APEX V-6.2, P. 66

even use the vertical space above the cabin for sleeper pods if the aircraft allows, like that of Japanese sleeping pods. The idea is appealing for multiple classes, but the question of where the space will be taken from or how it would be distributed amongst the various classes has yet to be resolved.

## 8. Promotional Class

More so an incentive program than an entirely new layout, this class would address how passengers view the middle seat when selecting their cabin location. One method suggested making the middle seat cheaper for those who get stuck there as they don't have the same view of the window or convenience of the aisle. Another notion would be placing random chance prize boxes on all the middle seats to incentivize passengers the chance to win various prizes. This could create a chance for outside sponsors such as Xbox, Nike or Adidas to have a stake in the airline industry, offering as the supplier of the chance boxes on the middle seats. All these are means of making the otherwise undesirable seat selection the new hot spot for future travelers.

## 9. Interaction Zone

From a recent poll taken among airline passengers, one third of its surveyed passengers wanted their vacation to start as soon as they boarded the plane. This zone would be a largely virtual interaction chamber within the aircraft. This area would be equipped to host game play, provide panoramic viewing, virtual shopping experience, digital workout programs, even host business meetings.

## 10. Cinema Class

We've all heard of watching a movie during a flight either on our own personal devices or the seat-back screen ahead of us. But what if there were something that provided the full experience of a visit to the theater all from 30,000+ feet in the air? Poppi airline has proposed a cinema-like cabin that resembles a movie theater equipped with curtains, dimmed lights and overhead screen. This cabin could offer cinematic pre-screenings, allowing passengers exclusive access to films that rest of the public doesn't even have access to in a small audience setting.

In the end, these are all only proposals and ideas that attempt to change how we view the standard of commercial flight. Since the greater majority of aircraft have not seen any drastic changes outside of replacement of worn or damaged seats and carpets and the installation of basic electronics, these concepts may seem like a far-reaching movement. By shining a light on how we perceived we have to endure travel versus how we want to experience travel, the ability for the modern, informed passenger just got a lot more exciting.





# LITERATURE REVIEW

## “Baggage’s Baggage” by Katie Sehl

APEX Experience - Volume 6, Issue 5

Carry-on luggage has been a challenge to creating a smooth airline passenger experience. But innovators are moving in to lighten the industry burden. A roundtable discussion was held between the following members in the aviation industry: Nick Careen, Senior vice-president airport passenger cargo and security for IATA. Christine De Gagne, Product marketing manager at Bombardier. Robert Lehr, Senior manager and central baggage services within Southwest Airlines. Devin Liddell, the Principal brand strategist for Teague. And finally, Russell Dicker, head of airport experiences for Uber.

“People don’t want to check bags because it’s a pain in the ass,” says Careen. Baggage that is destined for cargo bellies undergoes a more complex path than that of hand luggage. This means that there is also a higher chance that something, outside the realm of the passengers’ control, could be damaged, stolen or go missing entirely. Another primary culprit of the avoidance of checked luggage is the fee that is tacked onto bringing a larger bag. “Airlines in general are just drunk on baggage fees,” jokes Liddell. “Basically, bag fees are a fine for doing business with an airline. If I’m going to pay to have my bag checked, then I should get some value from that beyond just the hassle of a fee for actually having the audacity to bring some clothes with me.”

There is a clear motive behind this behavior though as well: money. Last year alone, airlines in the US took in more than \$2 billion in baggage fees; this accounts for about 20% of total airline ancillary earnings on average. However, there are outliers that don’t follow the same path of charging for checked bags. Southwest Airlines stands by its ‘bags fly free’ policy. “We believe that the customer our policy attracts and keeps outweighs the revenue we could generate for charging for checked bags,” says Lehr. The opportunity for businesses to make that same monetary gain based upon repeat customer business rather than fee-charging models shows how diversity can impact the stream of passengers through a business. Most airlines, however, do gravitate towards charging for checked bags with miscellaneous loopholes for rewards members and other customer loyalty programs that may get their bags checked for free.

What does this mean for the rest of the passengers? There hasn’t been a dramatic drop-off in passenger trends since moving from free to fee-charging models, as fees are only part of the problem. People don’t want to risk losing, damaging, or waiting for their bags on their parallel journey on the other end. This means that people are bringing more into the cabin with them in their carry-on or personal item.

The issue arises when there is not enough space for the bags of every passenger on board. For example, the CS300 can fit up to 111 carry-ons but seats a maximum of 160 passengers. The rules are posted about size and weight restrictions are known, but not always followed within the airline industry. “There’s actually a total lack of justice



Figure 19 | Baggage's Baggage | APEX V-6.5, P. 66



when it comes to carry-on baggage,” said Liddell. “If someone follows the rules set forth by an airline, they are charged to check a bag. Other people bring larger and larger bags on board, and then at the last minute, once the airline realizes there’s not enough room for these bags, it offers ‘courtesy’ checks. So you are basically rewarded for circumventing the rules.”

IATA tried rolling out an initiative called “Cabin OK”, where bags that met the predetermined size requirements would be labeled “Cabin OK.” After consultations with Boeing and Airbus, 22 x 14 x 9 inches was the agreed upon dimensions. This initiative was cancelled 9 days later after severe backlash from the passengers being “swift and vicious,” says De Gagne. The idea had great theoretical potential, but the logistics would have been challenging for the airlines as they each have different carry-on size metrics. Demand from the passenger has pressured airframers to create larger bins. New models of Bombardier’s C Series offer the largest stowage in its class, accommodating bags as large as 24 x 17 x 11 inches.

Carry-on baggage allows the passenger fast point-to-point travel, especially in the case of their business class travelers. Poppi, a future airline of Teague, mentioned as an example of the Click Class\* where passengers can plug their wheeled bag right into their seat to help enforce passenger loyalty. “I actually believe it should be the other way around. I should probably pay to bring my bag aboard, because that is the value of convenience,” suggests Liddell.

A general understanding that the way airlines handle baggage is outdated and poised to change very soon. Baggage tracking measures are gaining traction so that passenger and airline industry both can track the belongings in real time. Delta Air Lines is ahead of the pack already, having invested \$50 million into a radio-frequency identification (RFID) embedded bag-tagging system that can track bags from check-in to final destination. These systems are already deployed at 84 American airports so far, reducing the potential for human error, scanning bags at an accuracy rate of 99.9%. Synced with “Fly Delta” app, passengers can track where their bags are from their personal device.

Uber has entered the picture of passenger baggage claim and retrieval, talking about offering a service where a paid driver would collect the belongings and deliver them to the passengers designated hotel. “Uber Luggage” is what they’re calling it, though the name may change with further development. “Right now, we frankly have more questions than answers, but these are the types of puzzles that get us excited,” told Dicker. This traction of an outside entity moving in to capitalize on the passenger/baggage market is raising some eyebrows in the aviation industry. “The fact that Uber stepped in should be troubling to airlines on a couple of levels,” says Liddell. “It’s an example of someone stepping in from the outside to fix stuff that we should be fixing.

If we're not willing to step up an industry and improve, then we deserve what we're going to get, and that's disruption."

Baggage bins and the means of transporting it to its final destination is something that the airlines and commercial services can duke out on their own time. What is more exciting is how the conversation of the typical airline cabin is in for a transformation all its own as well.

# RESULTS FROM LITERATURE REVIEW

## Main Lessons & Takeaways

I remember the first time I got onto an airplane and the excitement that came with being able to fly for the very first time. I was 8 years old headed to my aunt's house in Georgia for our family Christmas. The sound of engines starting up, feeling my ears pop from the air pressure change in the cabin, and of course being pinned back into my seat upon takeoff. The airplane becomes a platform for new experiences for young and old alike. I want to eliminate anything that doesn't aid in making each trip more enjoyable than the last and create a new way of viewing the air travel for the better.

These articles offered great insight as to what conversations are already being started between the airline industry, airport officials, and those in charge of catering to the highest quality passenger experience throughout their journey. The first article I studied set out to define comfort and explained a lot of the complex nuances that go into trying to find that sweet spot that make as many passengers comfortable as possible. The ideal situation would be pleasing the needs of 100% of the customer base but this is easier said than done. Since there are a wide range of passenger types with even larger range of desired accommodations, airports and airlines can only do their best to create the most attractive setting for the largest demographic of people and offer supplemental accommodations for those with diverse needs.

One way that I see airlines trying to tackle the topic of diverse interests is within the various classes of aircraft travel. By separating people into the (typically) 3 classes of the aircraft, they are better able to manage what space and services are dedicated to each respective group of people. I have always wondered why this method of segregation by ticket price had been the deciding factor when it came to passenger flight layouts. By reading about the new proposals that the industry was beginning to prototype and test in the industry, I am much more excited to hear that the new classes have taken much more into consideration. The same aircraft is taking all of its passengers to the same location, departing and landing at the same time as the rest of the classes either ahead of or behind you. Why not design a more creative way that allows passengers the ability to choose their desired experience onboard, rather than just their class order in the airplane? By creating these new and more engaging spaces that passengers can choose to sit along their flight, you create a more exciting ride for the passengers in each zone, as well as a sparked interest for those that may have never tried various zones before. This level of 'choose your own experience' rather than just 'pick a seat' is something that I feel could really help redefine how we view air travel as passengers asking more of our airline services.

While on board, passengers also want to be able to access means of entertainment, commerce, or relaxation depending upon their style of travel. Without creating a custom seat and amenities package for each passenger individually, it is more feasible to provide all types of services for all passengers just in case they should need it. Allowing

passengers onboard to adjust and modify their respective surroundings to their likings would ensure a more enjoyable flight, granted their settings do not conflict with those passengers around them. For what small piece of real estate you're allotted while in the air, the chair and console are typically your main pieces of comfort, entertainment, relaxation or utility. These past articles about the proposed redesign of the passenger seat is one that offered important detail to how the seat must be, first and foremost safe, but also fit the body. I want to look deeper into the ergonomic standards that airlines are using to host the passenger. I want to also go a step further and see where advances in material science and modern technology can further improve the comfort and durability of seats and surfaces within the airplane.

The second piece focuses on what the passenger is allowed to do within the cabin while in flight as well. Space acts as the main deciding factor of what passengers will tend to do while in their seat. If given more space and provided that the suggested activity doesn't endanger or offend other passengers, I believe that the passenger should not be limited to the size of their tray table to knit, read, eat or work on a small tablet or laptop. With flight times limiting people to their seats for extended periods of time, it only seems right that they should be able to do more than sit on their phone for the entire duration of the flight. Where are the spaces to stretch and move about? Why does walking amongst the aisles of an airplane seem like an offense when really it is what most passengers would long to do in order to stretch their legs and get the blood moving again? Since there is no space to allow passengers a 'place' to go other than to the restroom, the act of moving while onboard seems to be limited to absolute utility rather than leisure or pleasure. If there were pockets to stand, stretch, socialize or sprawl to your liking, I believe that the overall approval of passenger on long-haul flights would increase dramatically. Even if for a few minutes, the ability to stretch and move your legs in any means of travel is a wonderful feeling that I feel is highly underrated. It should be the duty of the airline to recognize this need and prioritize them over those of just getting as many paying passengers onboard as possible, as this shows a clear bias that favors their ticket fare over their enjoyment.

This is where my thesis hopes to intervene, starting the important conversation of challenging how passengers are being dealt with when they should be celebrated; where attitudes towards travel is something to be endured rather than get excited about. These articles are just a few of many others that have helped spark the interest within me to seek out crucial pieces of information that either make or break the overall approval of the airline passenger experience.

# TYPOTOLOGICAL RESEARCH:

## Precedent Study Criteria

When selecting the following case studies for typological research, five main factors were given consideration:

1. Typology  
Airport with International Travel Capabilities
2. Context  
Must be based in a larger metropolis similar to my site
3. Volume  
The airport must handle the same, if not more enplanements per year as my site
4. Passenger Accommodation  
Technologies and systems must be put in place to accommodate the passenger
5. Connection to the City  
Transportation means created to better connect metropolis to airport

The following projects were given special consideration for typological research:

ATL | Hartsfield-Jackson Atlanta International Airport  
*Atlanta, Georgia - USA*

ORD | O'Hare International Airport  
*Chicago, Illinois - USA*

LHR | London Heathrow International Airport  
*Longford, London - UK*

# TYOLOGICAL RESEARCH:



Figure 20 | ATL Aerial Photo | Credit Jose Ramos



Hartsfield-Jackson Atlanta International Airport has blazed the trail for exponential airport growth and booming capacity. When it started, the airport was placed on an abandoned racetrack called The Atlanta Speedway, 287 acres in size, and signed a 5 year, rent-free lease by Mayor Sims at the time. This now massive complex of 7 terminals, over 4,700 acres has been number one in both the U.S. but also the world. The airport has carried the title of "World's Busiest Airport" since 1998.

ATL carries an immense weight of financial obligation to the surrounding area. With a \$58.2 billion dollar footprint, the airport is Georgia's #1 revenue generator and largest employer, with 63,000 jobs on site.

By studying ATL, this case study will help me understand what methods the busiest airport in the world is using to not only process a large number of passengers, but also study how the passengers' experience has been addressed as well.

**AIRPORT RANKING:** #1 in USA - #1 in World  
(PASSENGER COUNT)

**AREA :** 4,700  
(ACRES)

**RUNWAYS:** 5

**GATES:** 192

**PASSENGERS :** 107,394,030

**PARKING:** 30,000+

**OTHER INTERESTING FACTS:** 6.8M Sq. Ft. Terminal Area

8,700+ Rental Cars on Site

263 Concession outlets:

2,700 Arrivals +  
Departures Daily

Averages 275,000  
Passengers a Day

Tallest Air Traffic Control  
Tower in North America at  
398 ft. - Fourth Tallest in  
the World




# TYOLOGICAL RESEARCH:



Figure 21 | ORD Aerial Photo | Credit Skytamer





O'Hare International Airport was chosen as a case study due to my experience while in this airport. Wayfinding was very easy due to efficient signage and intuitive spatial arrangements; there were always a variety of services and amenities at each gate in order to save passengers the need to walk a long distance to reach a restroom, coffee shop, magazine stand etc.

This airport also pioneered elements of airport travel such as concourses, direct highway access to the terminal, jet bridges, and underground refueling systems. Due to these leading innovations, O'Hare had been the World's busiest airport from 1963-1998 when ATL stole the title which it still holds today.

The airport is also undergoing a massive transformation that will boost the terminal area to 8.9M square feet. I got a chance to see some design elements during my time with one of the firms in charge of creating the new design drawings for this transformation. I hope to revisit once the renovation begins to see what else improves.

**AIRPORT RANKING:** #3 in USA - #6 in World  
(PASSENGER COUNT)

**AREA :** 7,627  
(ACRES)

**RUNWAYS:** 8

**GATES:** 191

**PASSENGERS :** 83,245,472

**PARKING:** 22,594

**OTHER INTERESTING FACTS:** 5.5M Sq. Ft. Terminal Area

67.6% On-Time Percentage

Was an Active Fighter Base during Cold War

# TYOLOGICAL RESEARCH:



Figure 22 | LHR Aerial Photo | Credit Climate ADAPT

London Heathrow International Airport was chosen as a case study due to my experience traveling through the airport in a foreign country, but also my exposure to its public transit system that connects the city to the airport. This case study was my firsthand experience with an airport outside of the US.

One element that I appreciated about London Heathrow was the amount of natural light that flooded all areas of the building. From check in to security, concourse to gates, the amount of daylighting throughout was more than that of any other airport I'd experienced in the past.

This airport has also seen a steady increase of passenger travel at 2.7% increase in 2018, which is slightly higher than the majority of other countries reported growth rates.

One interesting innovation that the research on this airport showed was that LHR's T2 terminal is one of the first terminals in the world to be powered by 100% renewable energy. This push to create a cleaner energy in an emission-heavy industry is one that is inspiring for future designers.

**AIRPORT RANKING:** #1 in UK - #7 in World  
(PASSENGER COUNT)

**AREA :** 3,032  
(ACRES)

**RUNWAYS:** 2

**GATES:** 231

**PASSENGERS :** 80,126,320

**PARKING:** 22,594

**OTHER INTERESTING FACTS:** 6.6M Sq. Ft. Terminal Area

Had a 78% success rate of departures within 15 minutes of schedule

Baggage performance is at 98.8% reported in 2018



# PROJECT JUSTIFICATION

This project is important to me because I am drawn to addressing how architecture must serve people; not making people adapt to the architecture. Aviation is a special region of interest of mine because it is a much livelier environment in which people use. I want to change how people view transportation via air travel because it is something that I believe is long overdue.

I think it is important for this project to happen now because I am nearing graduation and will soon be looking for professional employment. This project will serve as an example of the type of work I'm interested in, as well as represent the type of drawings, information and graphics I am capable of producing. Thesis should be the accumulation of all the learned lessons throughout my college education coming together to develop a cohesive narrative in my project, telling my story through my design.

I would like to go into a smaller scaled design niche of architecture, bordering on the industrial design avenue that ties into architecture. It is important for me to use this year as a means of developing my project to the level of detail that a potential employer would like to see.

This project has already developed a much deeper knowledge base for me to pull from, both from existing topics that I had previously had an earlier understanding of, as well as introducing me to new areas of data and information that will help me develop a better understanding of research and design methodologies.

This project will challenge and develop my skills to new levels and on a much grander scale. This project presents data about airline travel statistics, annual revenue, CO2 emission statistics, trend forecasting in commercial aviation, and many more areas of information that had never come across my desk before this year. I think this creates a new and exciting challenge as I take pride in my ability to put together a cohesive, well-articulated argument of why a change needs to be made and moreover why mine is the best option for that change. Data representation and relatable motivation are going to be two key elements that I want to focus on because I want to be able to present this project to anyone and have them understand it with ease; without having an architecture degree or background. The ability to communicate with anyone is a crucial piece of becoming an architect, both inside the professional realm as well as in the more casual social setting. This project will act as the ultimate conversation piece for me to better communicate who I am, what I want to design, and why I feel it needs to be acted upon.



I think that the redesign of the airline passenger experience is important because of the growing rate of passengers that utilize airline travel all over the world, but also for the airport, airlines and passengers alike to open their eyes to new possibilities for what commercial flight could look like with the right innovators and proper design. We need passenger that are able to ask more of the airports and facilities that will transport them to different cities or countries, and my project will aid in understanding where we have been to better plan for where we are going as a service and customer relationship. Airports need to be catching up to what modern technologies are capable of in a world that has become infatuated with the idea of always riding the cutting edge of technological advances. I believe that aviation can be the catalyst that leads other industries into action of providing a comfortable, cost-effective, and ultimately client-centric experience that can change the paradigm of enduring travel, whereas we should be enjoying travel.

The whole project will expose me to entire duration of a research project from start to finish, and better prepare me for the preparation that needs to go into architecture before any designing begins. This is an important experience that almost comes too late in my academic career, as I have always thought I would like a research-based role in architecture, but never had the chance to explore that path in depth.

The aviation industry is a \$899 billion dollar industry whose impact can be felt by countless passengers, employees, service providers, and other ancillary roles that all are impacted by the aviation industry in some way. By creating a more enjoyable user experience, the industry would benefit greatly by upgrading where needed and developing changes where necessary as well.

The funding for this project might come from the commercial airline providers as a means of improving their passengers' experience while doing business with them. Additional funding may come from the airport itself due to the improvements that would be done to streamline its processes and improve its capacity to handle more passengers each year.

The returns would be both monetary and intangible. The overall success of this project would ultimately mean a higher level of joy that comes with air travel and utilizing these specific airline providers due to their thoughtfulness in customer service. This would generate more revenue from the repeat passengers who choose to use Sea-Tac as their hub airport. The intangible would be the overall quality of travel that the passenger experience while on their journey; these increased levels of relaxation and comfort would make for a happier customer base, resulting in better reviews of service overall.



Post-occupancy impacts would include a higher standard of quality that both the airport and airlines are held to when addressing passenger needs. This would mean a lower stress level on the passengers' plates, fewer unexpected charges and fees throughout the travel process, and a greater sense of control placed back in the hands of the passengers. These means would justify the application of the project because re-empowering the passenger makes for better perception on the customer's end.

The technology needed for this project has not been explored in its entirety, but current plans would use existing technologies and devices in circulation today. The main differences would come from how the passenger engages with them and at which points are screen-friendly and screen-free zones depending upon the stage in travel. There also is potential for a system to better consolidate the number of times that passengers need to access their phone during wayfinding, ticketing, boarding, etc. throughout the journey as well.

The project is perfect for the chosen location of Sea-Tac Airport because of the high annual traffic this airport sees, the numerous means of connection to the city center, and small footprint that the airport holds making it the ideal subject to develop and test my thesis proposal on. During my visit to the airport, I was also inspired by the layout of the hold areas, gates, and terminal spaces to make improvements that could create a more positive experience.

I believe that this project would advance the profession by defining a very specific problem and addressing where the issues effect humans on a smaller scale. Design holds the potential to solve problems on all scales. This project would follow the problem through all the various scaled settings that the passenger experience is owed an improvement.

# SITE ANALYSIS PHOTOS



Figure 23 | Site Analysis





Figure 24 | Site Analysis



Figure 25 | Site Analysis





Figure 26 | Site Analysis





Figure 27 | Site Analysis





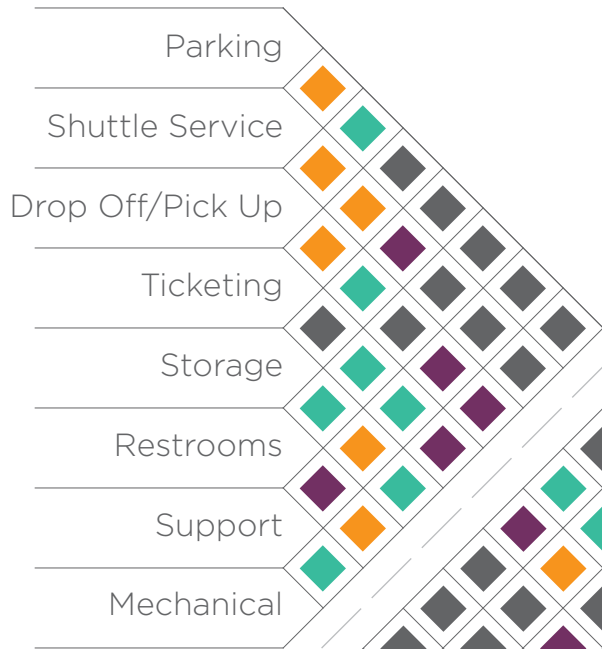
Figure 28 | Site Analysis

# PROGRAM ADJACENCY MATRIX

## Program Adjacency Matrix

Contextualized in Commercial Passenger Terminal

### LANDSIDE



### AIRSIDE

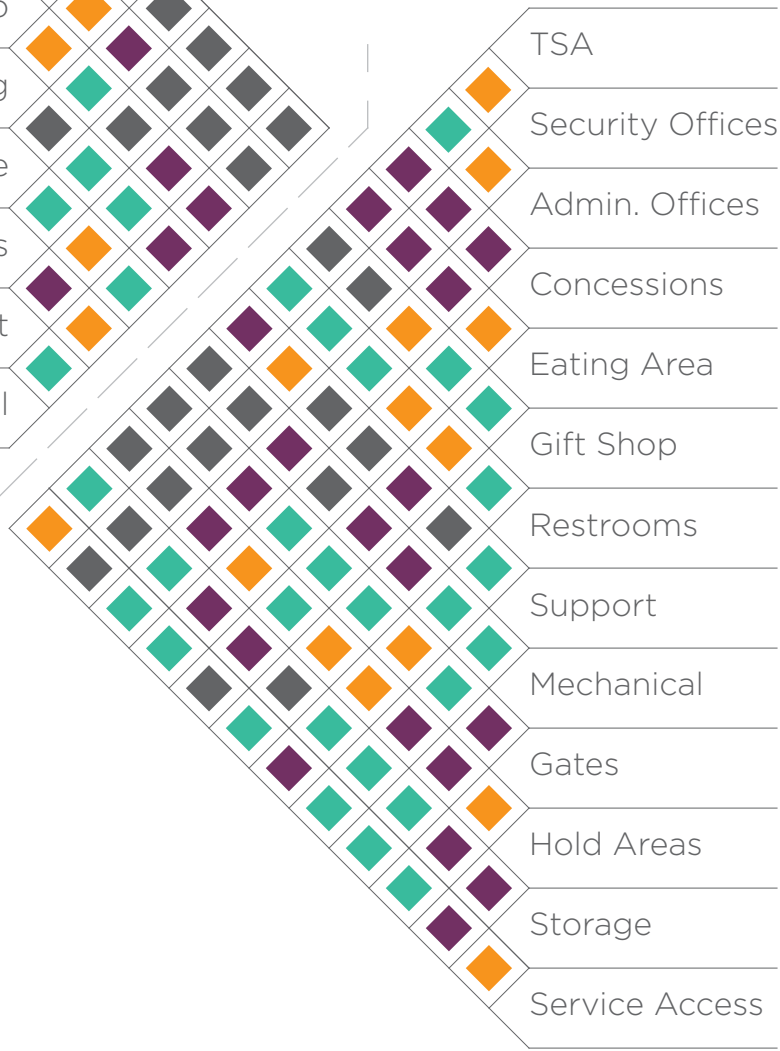


Figure 29 | Program Adjacency Matrix

# PROCESS DOCUMENTATION

My process was recorded in several different ways. From the scanning of notes, drawing and diagrams; the interval saving of digital models and simulations; and the photographs of any physical models that were made, all processes can be documented. While the semester began as normal, creating physical and digital articles from my desk in studio, the shift to working from home due to the COVID-19 virus outbreak changed the outcome of produced materials. Without the use of laser cutting and 3D printing in particular, the plans I had made were changed significantly, reducing the amount of modeling work that I wanted to do in order to better develop my design. I had purchased material to be laser cut and purchased my own filament for the 3D printers to ensure a cohesive look to everything that I made, but all of this material never got used due to distance learning and working from home. Nonetheless, the overall project turned out well, making the most of what I could do given the situation I was dealt. As most of my work is in digital format, creating digital 3D models, 2D graphics and diagrams, etc. there was not much diversity to the type of deliverable I was able to produce for this thesis. By saving files both as their iterations developed, paired with their corresponding completion date, the lineage of work can be followed as it progresses.

# PROJECT SOLUTION DOCUMENTATION

The entirety of my presentation-grade deliverables can be seen in the digital presentation section later on in this book. These slides give a clearer idea of all the components that came together to make this project a success. The components include:

1. The JUMP App to be used throughout every step of the journey
2. The fitting of the Sea-Tac light rail station
3. The new proposed skywalk to be built on the Sea-Tac campus
4. The change in security screening methods and location
5. The reconfiguration of the spaces within the Boeing 737-800
6. The redesign of the passenger seat

All of these parts came together to make great improvements to the quality of experience that the typical passenger can expect when navigating their way through the commercial airline industry.



# CRITIQUE OF APPLIED RESEARCH METHODS USED IN THE THESIS PROJECT

When delivering my thesis presentation, the critics had mostly positive things to say with a few suggestions for improvement or consideration. The first of many comments was the appreciation of my thought process to address my thesis as more of a design thinking project rather than just a building design project. The college has been pushing to incorporate more design thinking projects from a push by the advisory board, and this project reflects those wishes as well as my own interest in working with design on a scale smaller than that of a building.

Another critic suggested that if I'm going to propose changes to the aircraft, don't be shy in making changes that make the passenger experience as good as it can possibly be; not just as good as the modern technologies can allow. The mention of creating an entire spectacle out of the interior of the plane was suggested, as well as studying how some airlines are creating destinations onboard their aircraft. The conflict with this suggestion lies with my early decision to not change the outer envelope of the aircraft, and keep it whole without major changes. Since my design relies on the integrity of the shell or chassis of the airplane, proposing major changes to the exterior, thus changing the look of the airplane, went against the goal to preserve its outward appearance. The spaces inside might be able to be improved with some more testing to allow more headroom for the lower levels, but with the timeframe I was on, I am pleased with the results of my design.

Finally came the concern of the financial impact of reducing the number of people onboard each flight and how this might impact the bottom line of the airlines. I responded by stating that I was designing for the improvement of the passengers experience, not optimizing for the most cost effective manner of transporting passengers. This could be another layer that gets added to the project for future development, creating a lens that asks how the improvement of the passenger experience can also become one that is well balanced against the financial needs of the airline to fly their passengers as comfortable and cost-effective as possible.

The critique eventually dissolved into casual conversation about how they see my design coming to use in circulation today. Small points were made about tight headroom or suggested alterations to the chair layout or design as a whole, but no major red flags were thrown at the research that I had done. Overall, I was pleased with how smoothly my critique had gone and plan to incorporate the suggestions and concerns into a future iteration of my thesis as I move forward.

# DIGITAL PRESENTATION

The following images are the slides used in my digital presentation followed by brief speaking notes that were delivered with each associated slide.



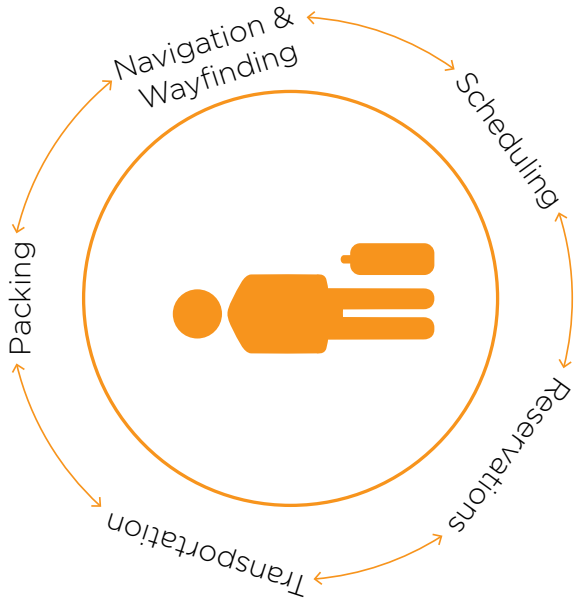
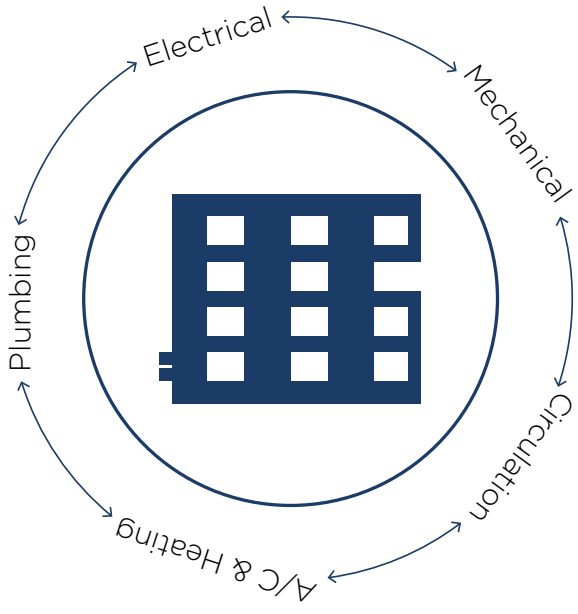
## Redesigning the Airline Passenger Experience

When beginning my search for a thesis topic, I gravitated towards something that I was passionate about. As a kid, I always loved watching planes fly overhead and the feeling I got when taking off in my first plane ride. It was something scary and exciting for the first time but for some reason that level of wonder has diminished the older I got. Somehow the want to recapture the wonder and excitement of flight still remained all these years later. Now I get to share my idea of how I see that happening with all of you.



identity of systems

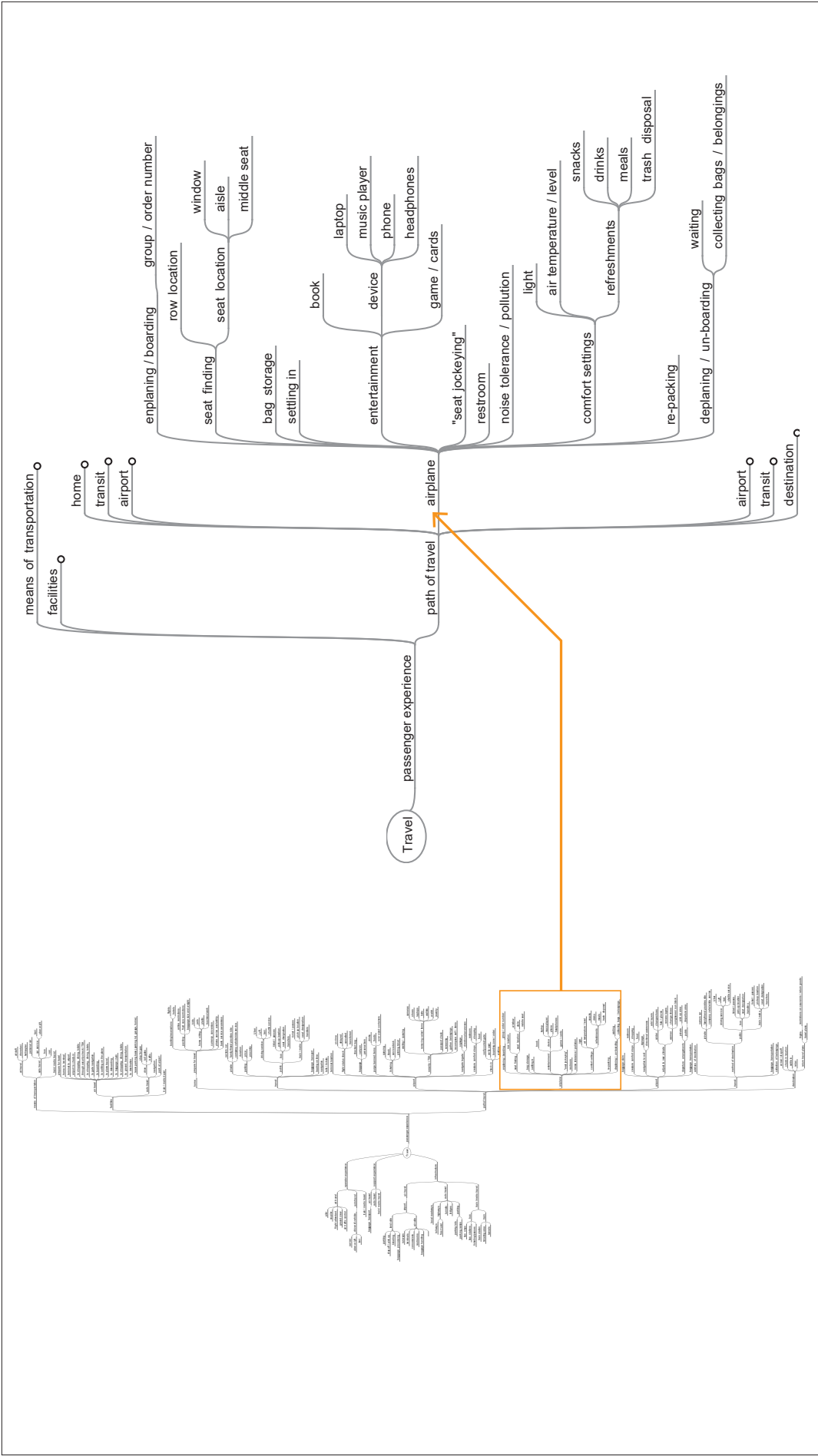
When reading about typical architecture thesis, I wanted to approach my project in the same fashion as those that focused on a building. The only difference is I wanted to focus on the traveler experience.



components of systems

Much like a building relies on a series of integrated systems, so does the traveler experience rely on a multitude of components in order to work properly. Neither exist in isolation, each are a piece of a larger puzzle, relying on the cooperation of all it's parts in order to function properly.

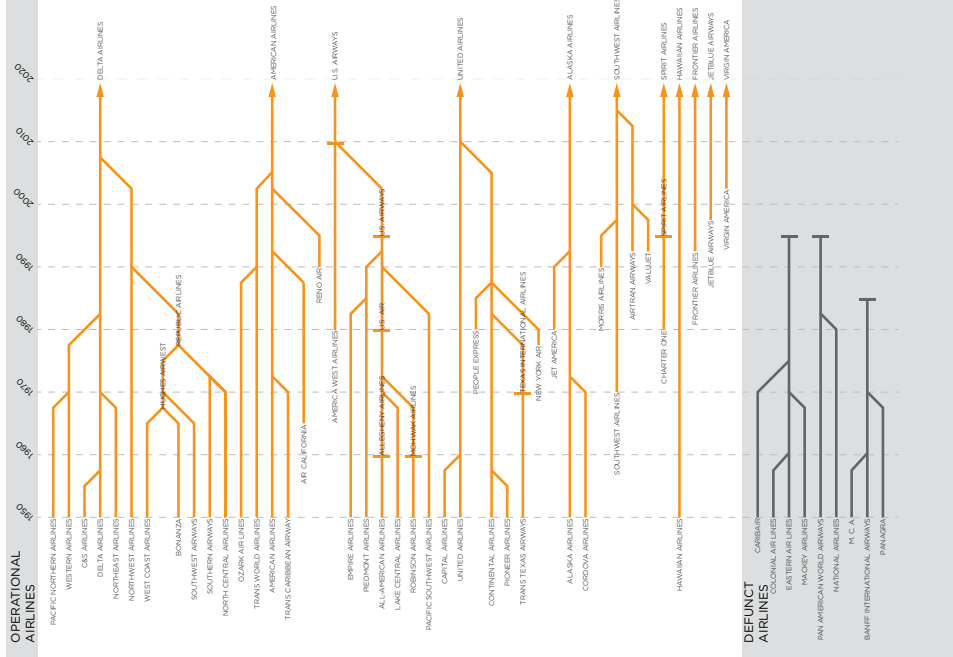




In my early research, I created an itinerary of all the events that can happen on the typical journey through air travel. This mind map helped identify where pitfalls or bottlenecks occur, highlighting where improvements could be made in my design.

# US MAJOR AIRLINE MERGER LINEAGE

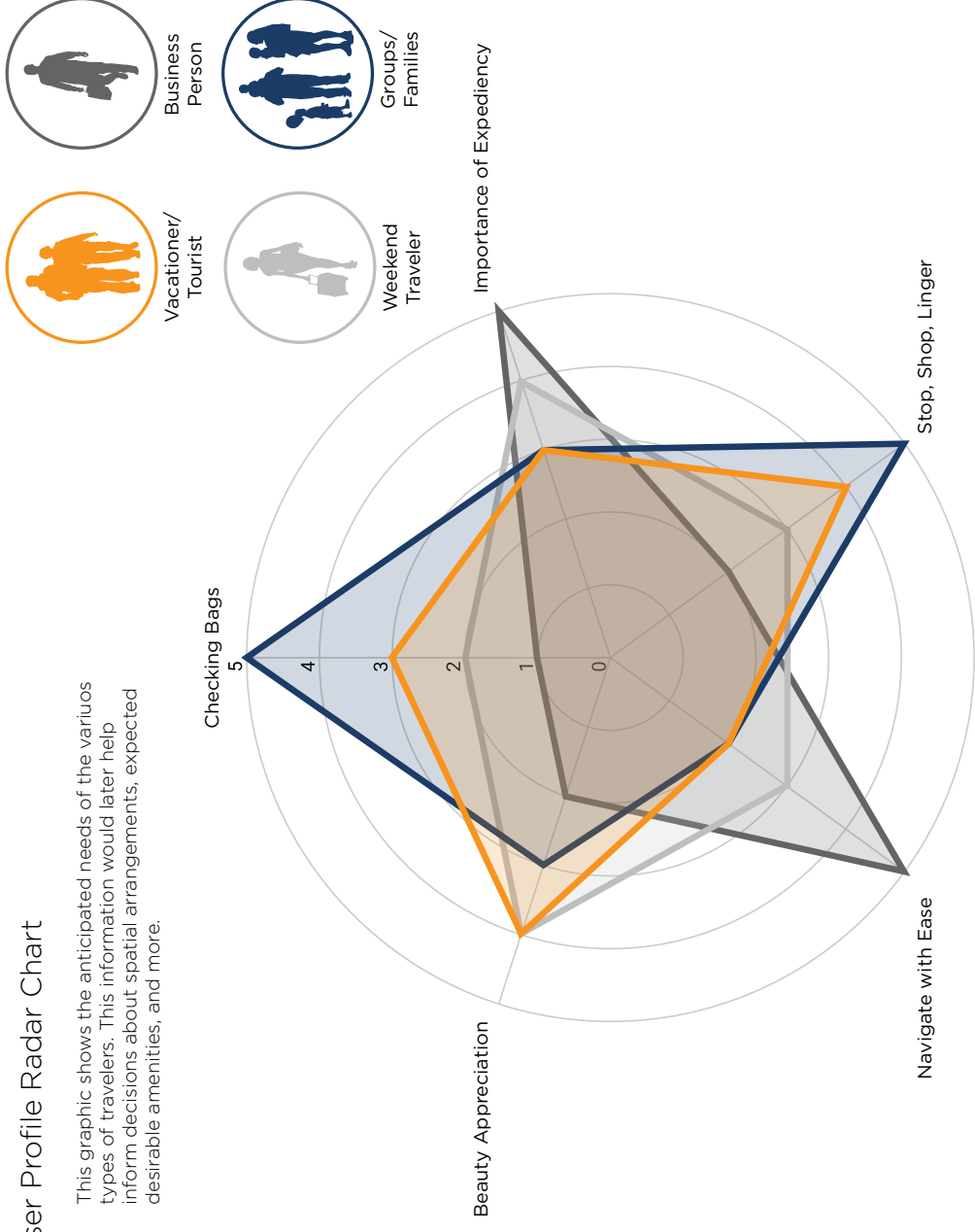
1950 - 2019



The nature of airlines is something that has changed greatly over our recent history. By studying which airlines had the longest lineage, I was able to see which commercial airlines were successful in catering to the everchanging needs of passenger, and which ones had failed.

## User Profile Radar Chart

This graphic shows the anticipated needs of the various types of travelers. This information would later help inform decisions about spatial arrangements, expected desirable amenities, and more.



To better understand what is asked of the modern airline, I created several user profiles that would represent the wide variety of people who would be using my design. While there are niche groups that are not included on this profile chart, the greater majority of the general population can identify with at least one of these user types.



## Top 5 Trending Passenger Requests

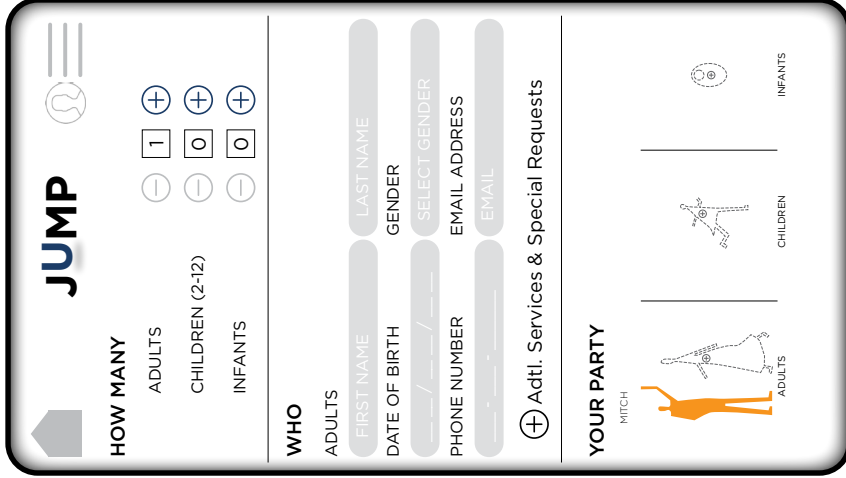
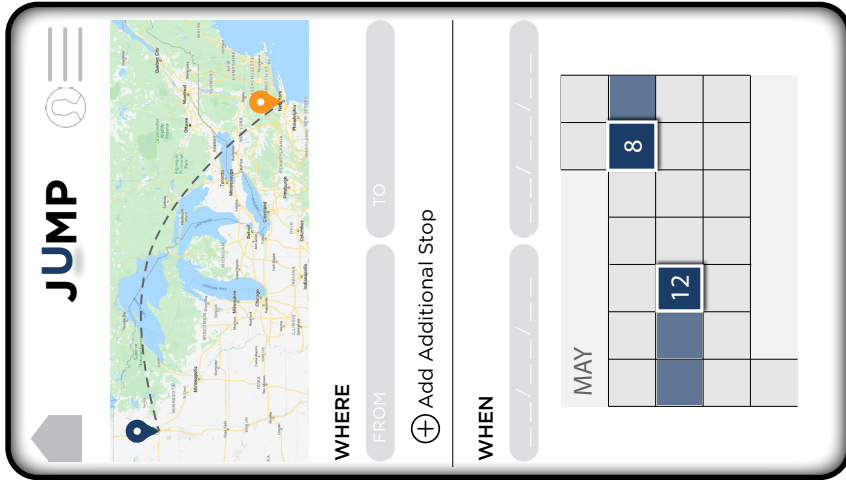
Info taken from IATA Global Passenger Survey 2019

1. The automation of a growing number of airport processes
2. A single identity token for all travel processes, using biometric identification
3. Real-time flight information sent directly to their personal devices
4. Increasingly efficient airport security that does not require having to  
remove or unpack personal items
5. Seamless border control

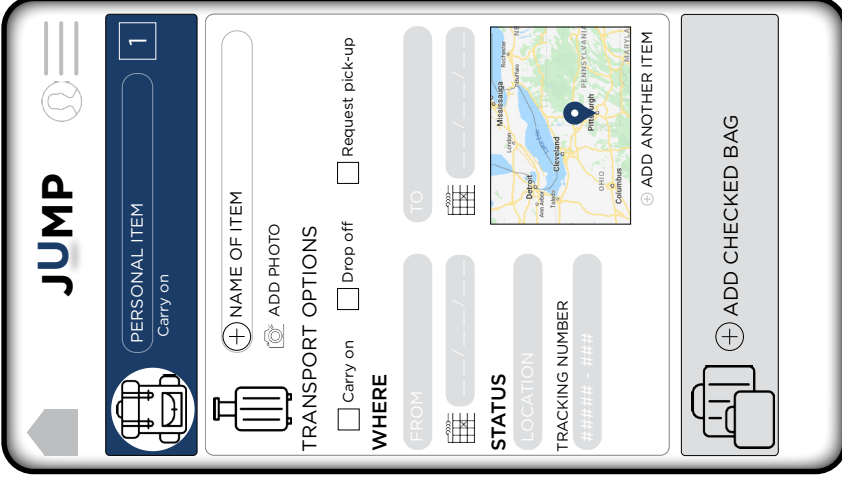
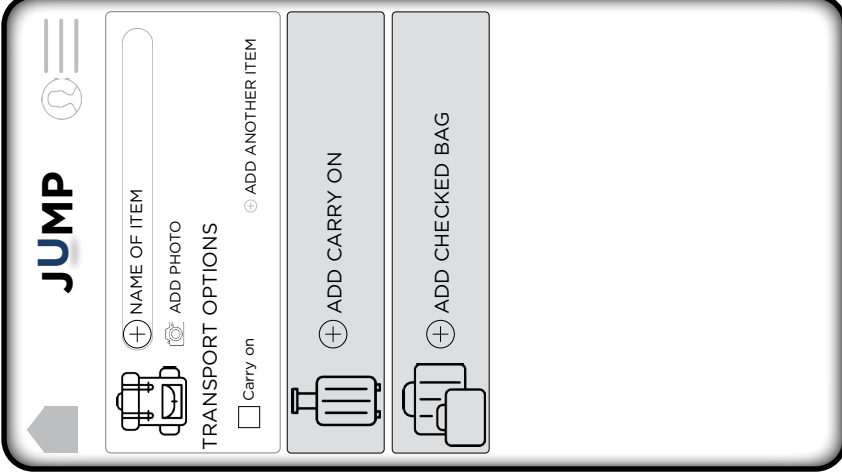
The airline industry is one that is very sensitive to the user reviews of their services. The success of each airline and airport rely on their ability to serve their customers, the airline passenger. After reading through an assortment of airline passenger experience magazines, websites and online think-tanks, these 5 points emerged as the most common trending requests of passengers today.



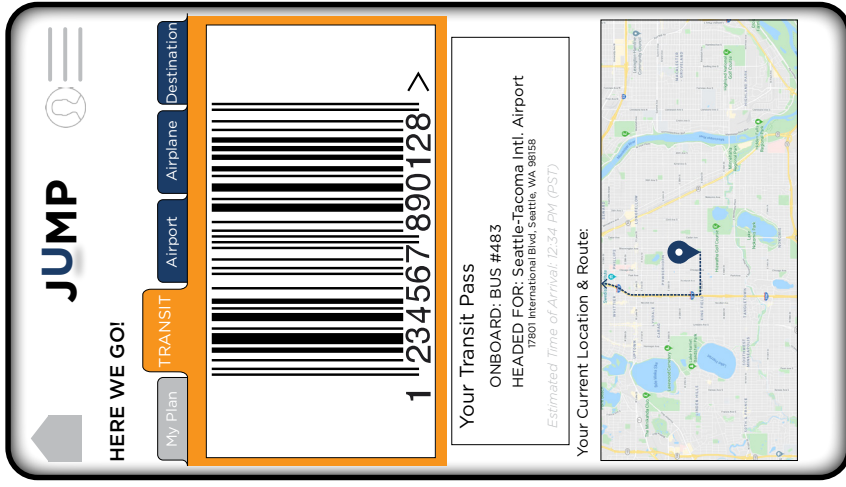
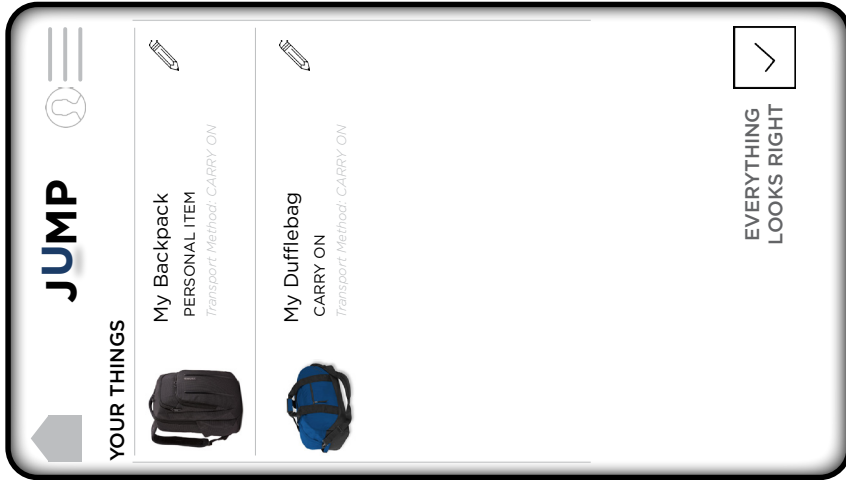
In effort to create an easily accessible users guide to travel, I designed an app made to flatten the learning curve for travelers of all experience levels. Introducing "JUMP", the app designed to get YOU in the air.



By simply selecting your desired destination and the duration of your stay, you can begin to plan your next adventure. Creating profiles for each member of your party, the app will be able to save you time by recording the necessary details for each member in your party and utilizing it at the required time. The app is designed to have visual verification at each step of the process, ensuring as few mistakes as possible before moving forward. One additional visual changes comes in the form of allowing you to view where open seats lie on potential flights before booking the airline.



Your destination accommodations come next, categorized by the type of stay you'd like to book for your upcoming trip. Recording your belongings come next, for both carry on and checked bags. Personal items are recorded with photo ID and registered to each passenger. Larger checked bags are no longer brought on the same aircraft as the passenger. Luggage will travel separately on existing parcel handling trucks and planes, being dropped off or picked up in advance and delivered directly to the destination. This frees up the space previously used by luggage and gives it back to the passenger.



After your bags have been registered and properly logged for their transport, you then move into how you plan on getting to the airport. The app stores your every choice in an intuitive manner, keeping your passes, directions, location and more in an easily accessible fashion. This allows you to enjoy your travels while JUMP collects all the details needed in one location for a smoother travel experience.



# JUMP

Let's get you in the air

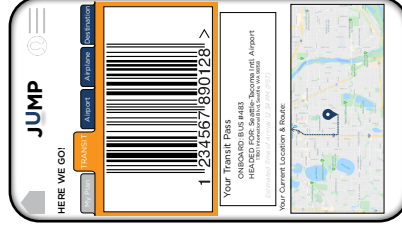
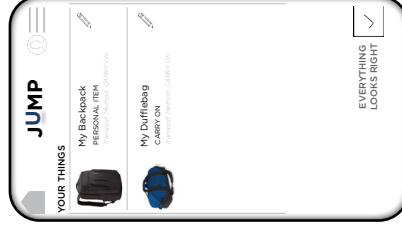
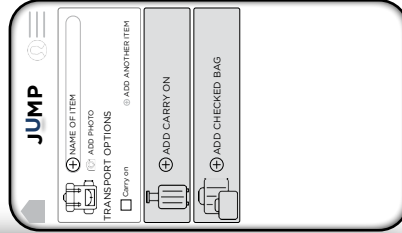
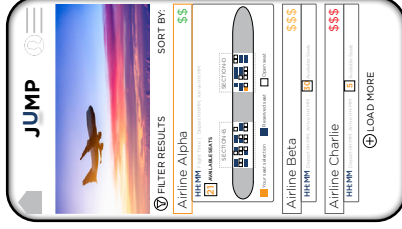
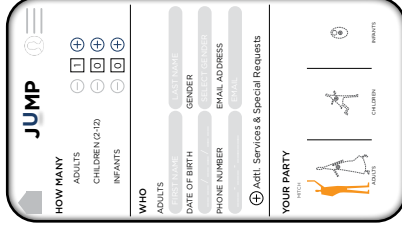
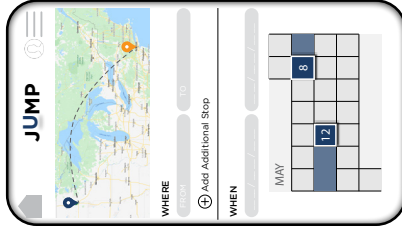
Make plans

My plans

Explore

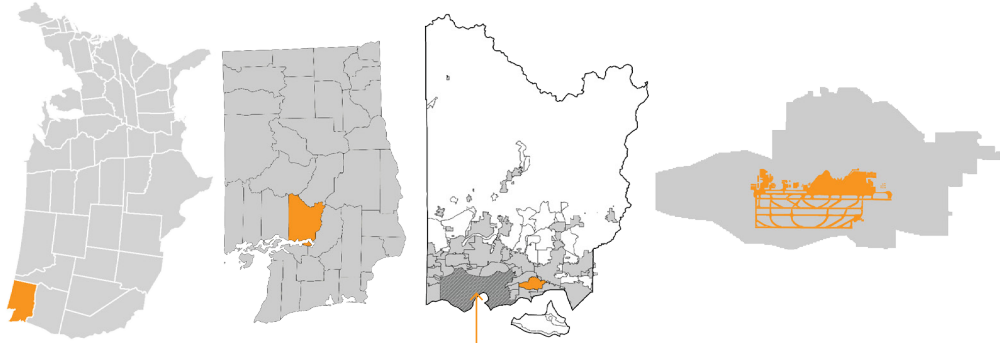
Help me find...

*This app would seek to combine a series of digital tools in a way that makes the user be able to follow their path of travel from start to finish, or in this case, door to door. Shown here are some sample screenshots of how I picture the UI of the app to appear. Designed to take all the jargon, hidden fees and unexpected detours out of air travel, JUMP would deconstruct the journey into bite-size pieces that even the most inexperienced passenger would understand and enjoy.*

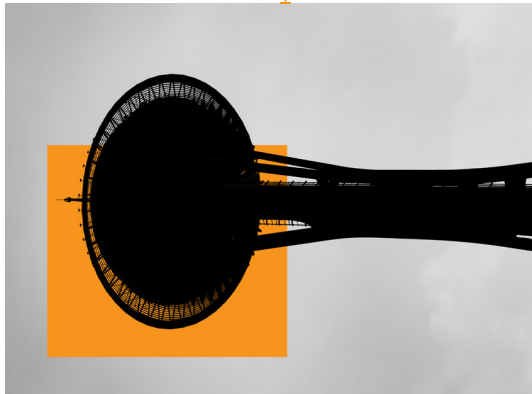
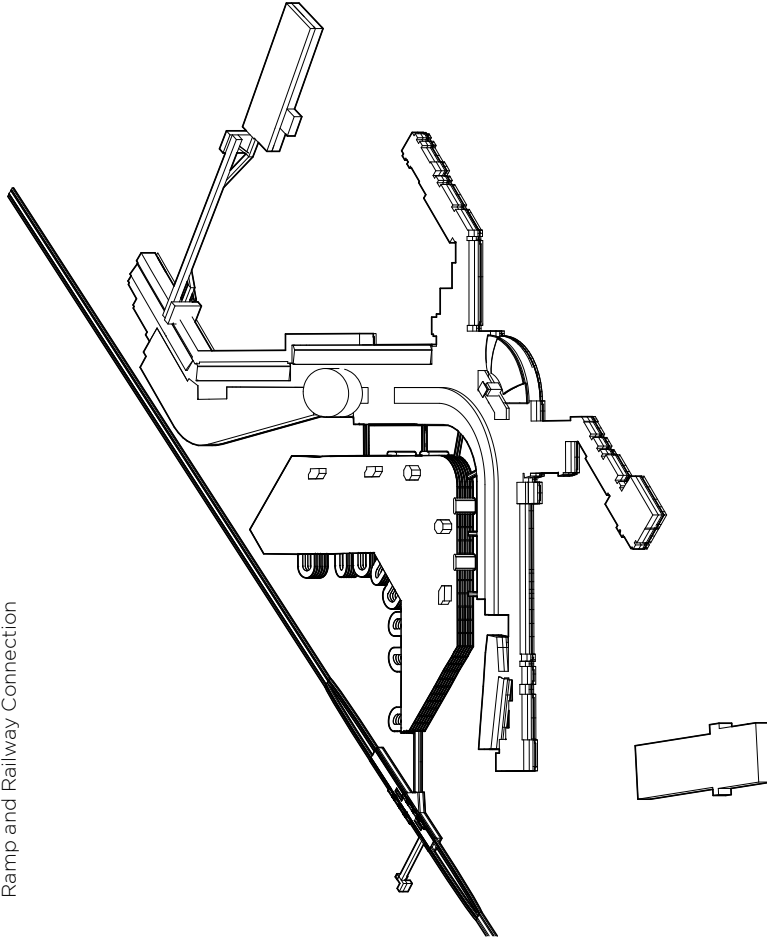


Home screen

JUMP is not trying to re-invent the wheel, only work out the kinks that makes the wheels roll a little smoother.



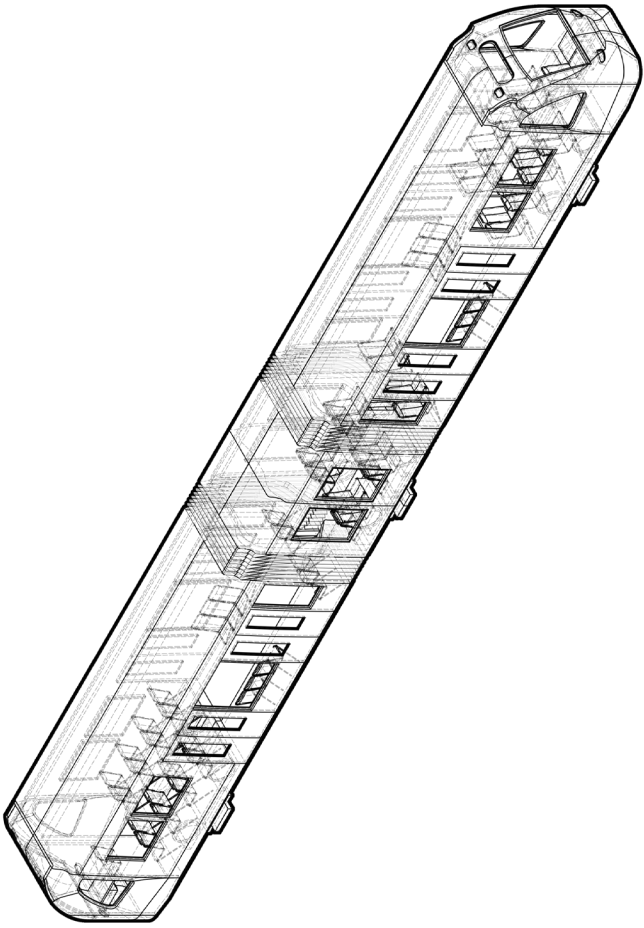
Seattle Tacoma Intl. Airport  
Shown w/ Projected Additions, Parking  
Ramp and Railway Connection



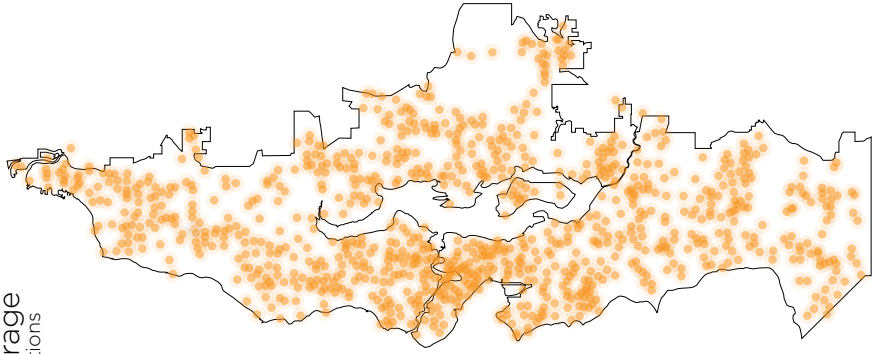
The site chosen was Seattle Tacoma International Airport, or Sea-Tac for short. For reference, Sea-Tac is about a 20 minute drive south of the Space Needle in downtown Seattle, Washington.



Sea-Tac Metro Light Rail  
Sound Transit | Siemens S70

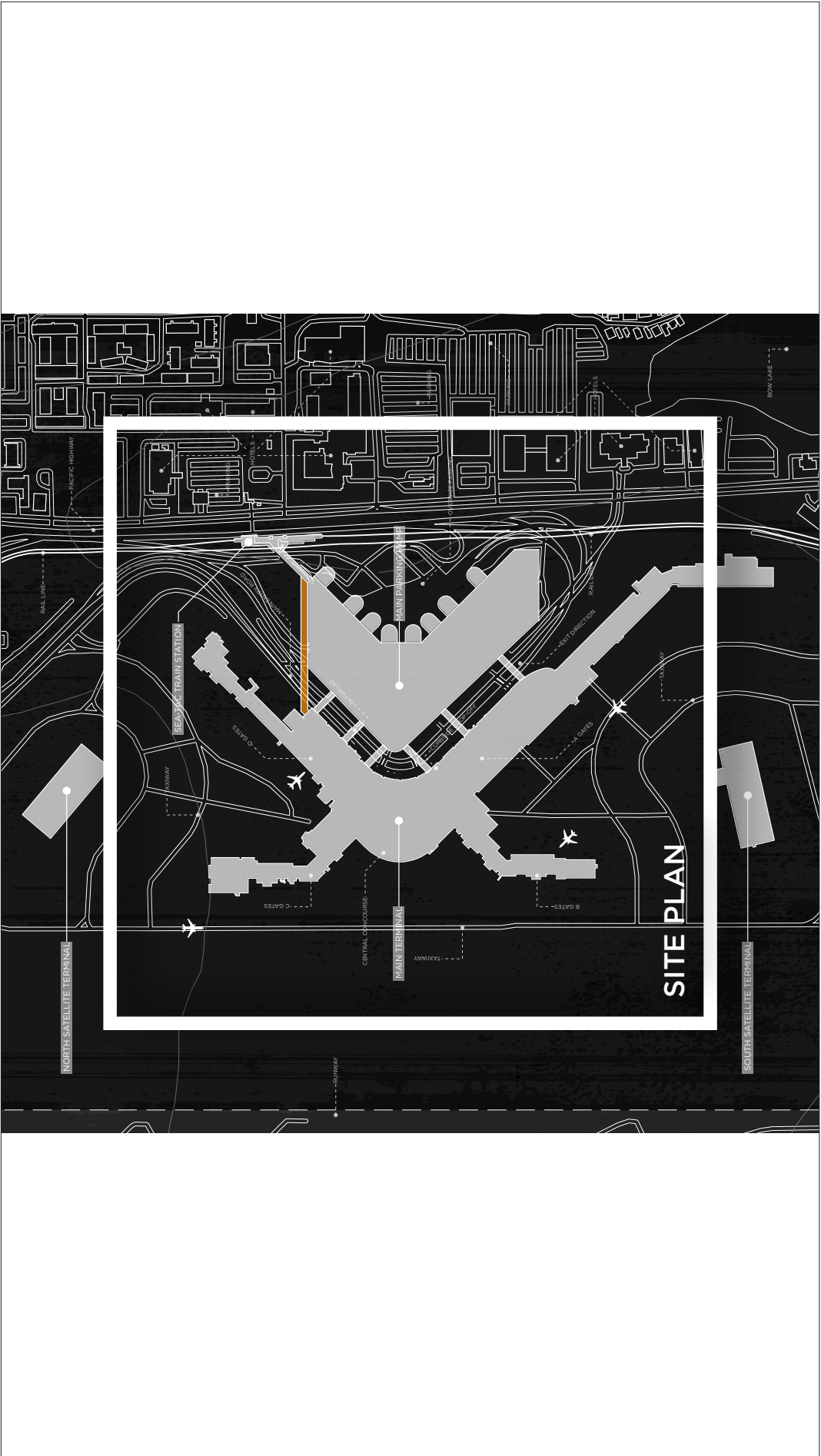


Seattle Metro Coverage  
Public Transportation Stations



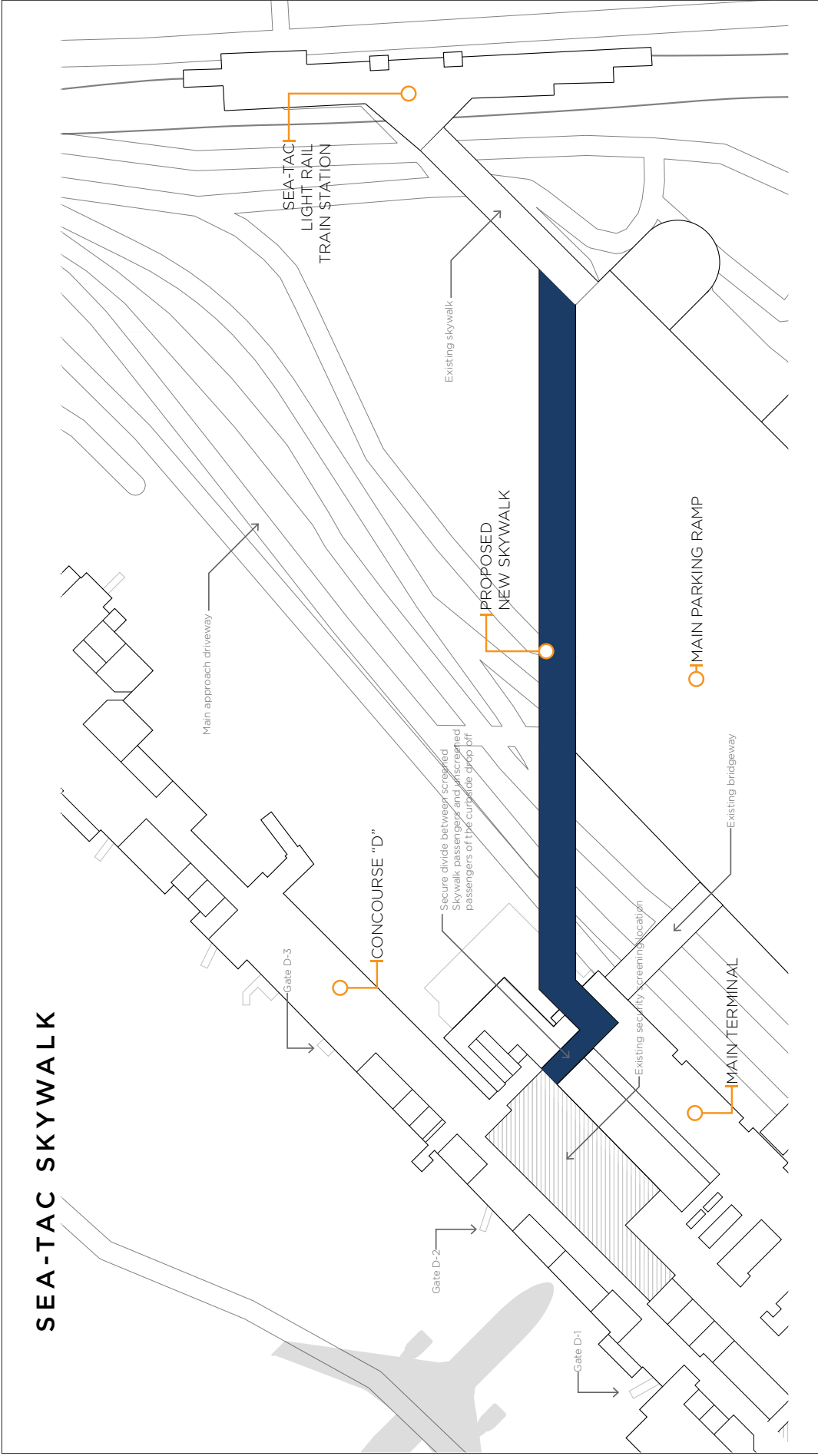
When addressing the transit to the airport, public transportation proved to be the most efficient method of travel. The Sound Transit metro system has great coverage of the greater Seattle Metro area, which is why I've chosen the light rail as my primary method of transporting passengers to my site.





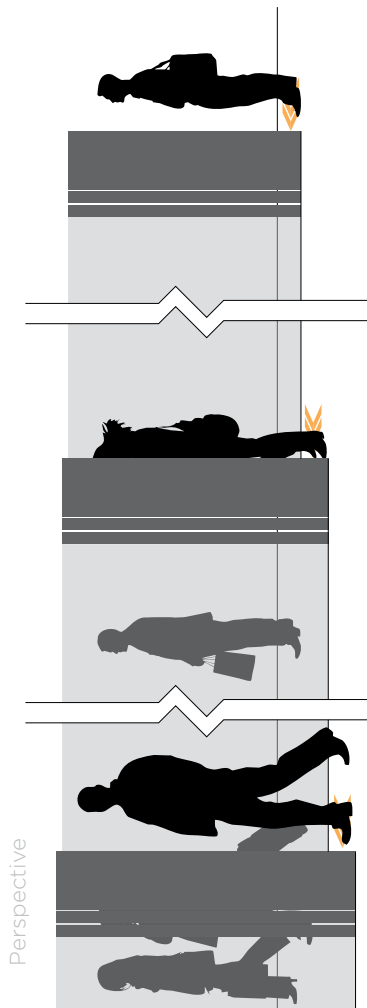
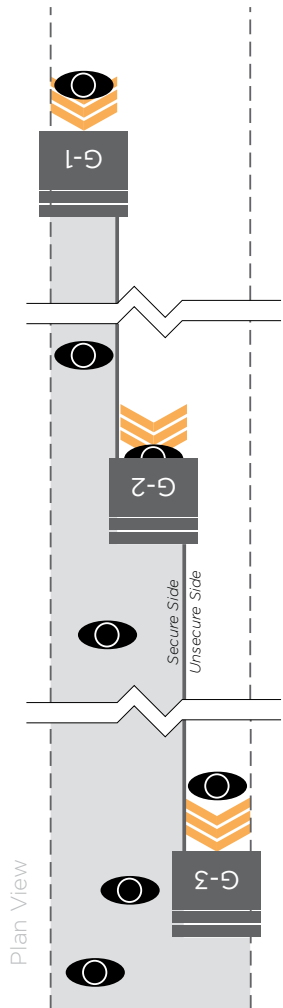
The light rail would deliver passengers to the train station attached to the Sea-Tac campus, eliminating the need for the additional step of finding and paying for parking of a personal vehicle.

# SEA-TAC SKYWALK



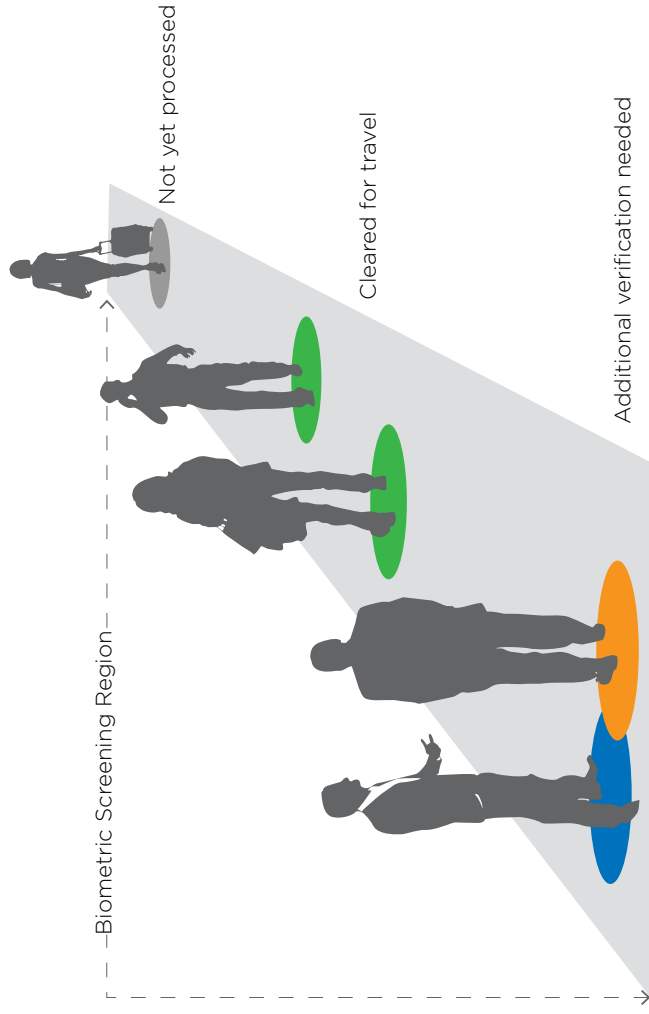
My new proposed skywalk would serve dual purpose: first acting as a covered walkway connecting passengers to the main terminal, while also serving as a passive security screening threshold. Using the length of the skywalk as an isolated security screening system, this design eliminates the need to wait in lines at TSA locations, producing passengers who would be ready to fly as soon as they spilled out into the main terminal.

## Skywalk Screening Gates Concept



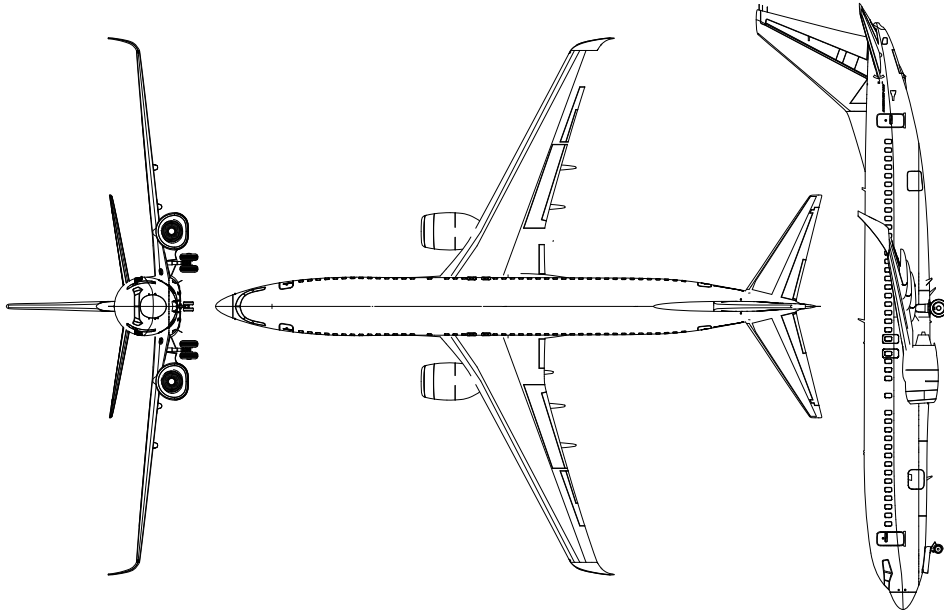
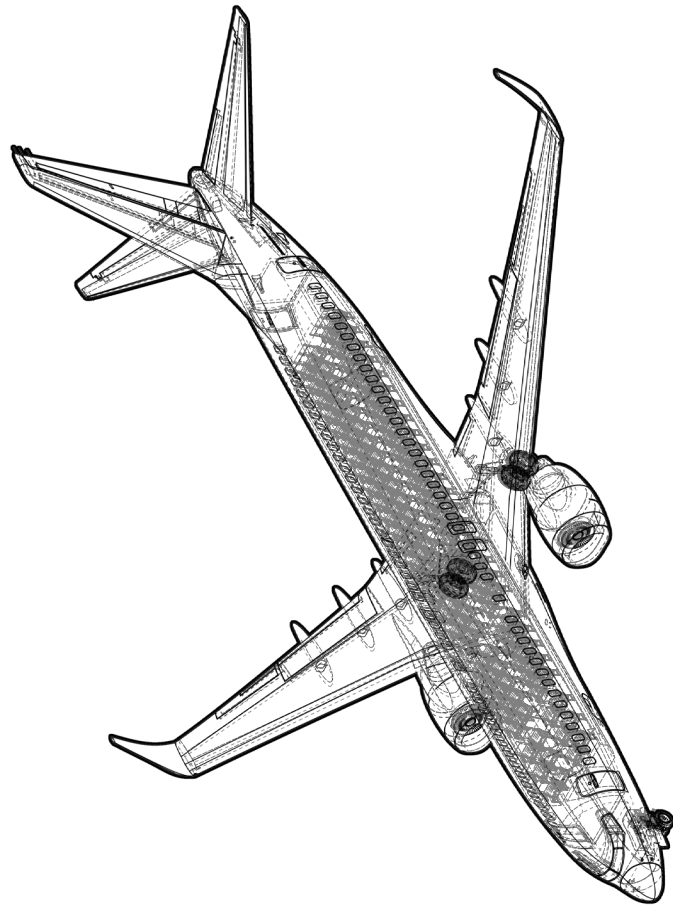
The skywalk would contain a multitude of progressively placed security gates, allowing the passenger to walk to the gate of their choosing before crossing through the screening threshold. Overhead, screens would display expected wait times at each successive gate, making for an informed incoming passenger who can choose their best path of travel.

## Passenger Halo Security Indicator



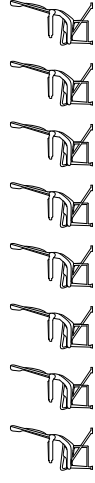
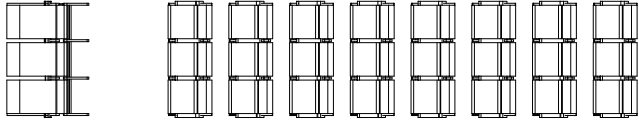
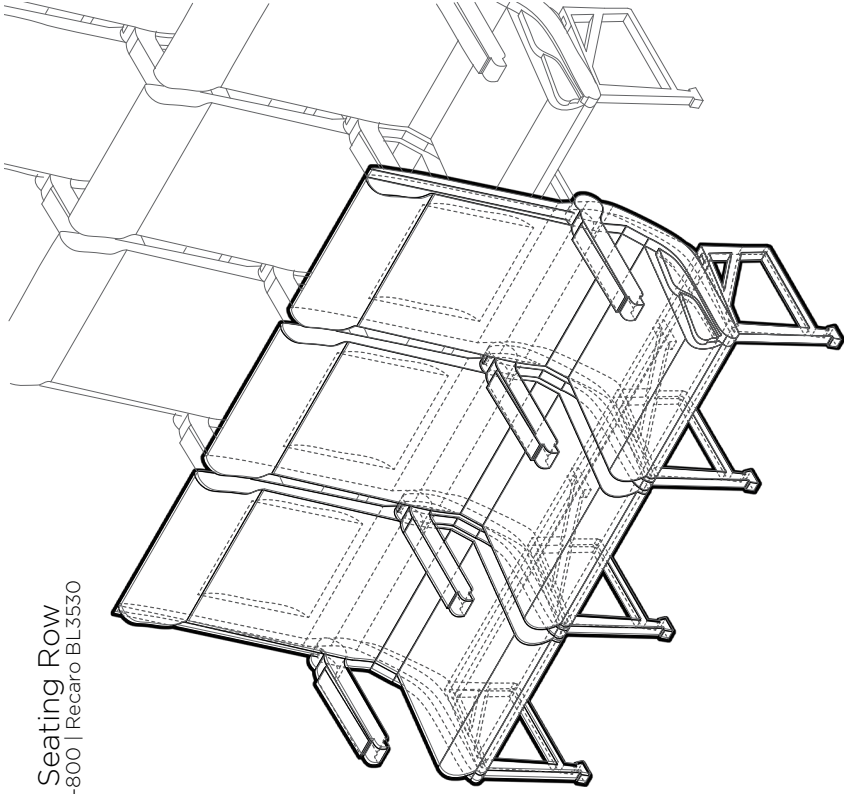
Once through the primary security, biometric screening would be paired with L.E.D. lined panels in the floor to display the status of each incoming passenger. Colored haloes would either clear or challenge the ability of each individual to continue on their journey without needing to be doubly verified by on-hand officials.

Boeing 737-800 Series  
Alaska Airlines | Passenger Aircraft



The Boeing 737-800 series was selected as the main aircraft of interest in this thesis due to its high use in long and short haul commercial flights. Since its introduction in 1967, purely cosmetic changes have been made to this iron giant, making it the perfect candidate for some much needed upgrades.

Economy Seating Row  
Boeing 737-800 | Recaro BL3530



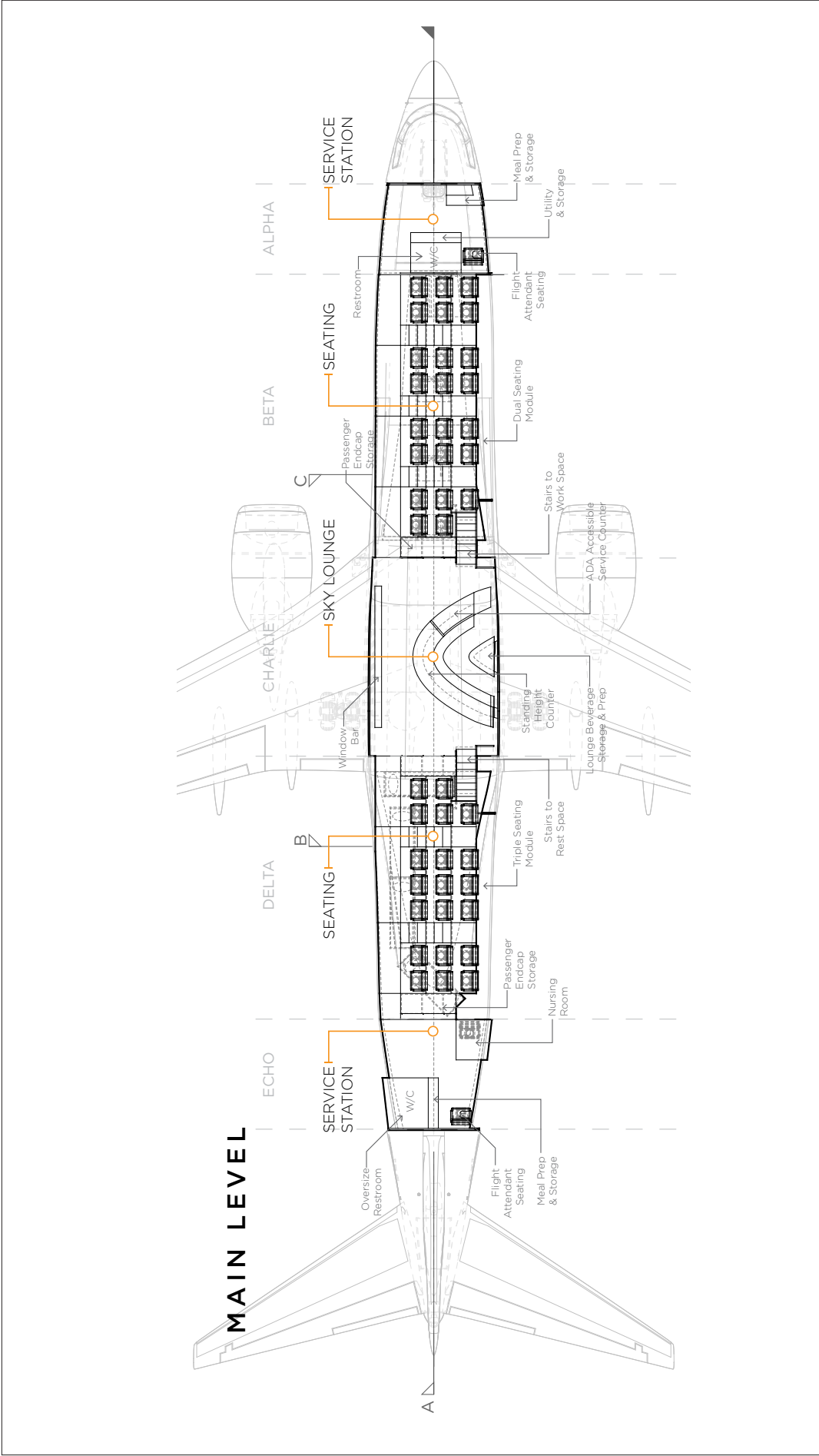
Lining the belly of this beast are a mirage of tightly packed seats that prioritize quantity of passengers over quality of the ride. Having been built using sturdy frames and lightweight materials, these seats would also receive a second life in the redesign of this aircraft.

THE NEWLY REDESIGNED BOEING 737-800



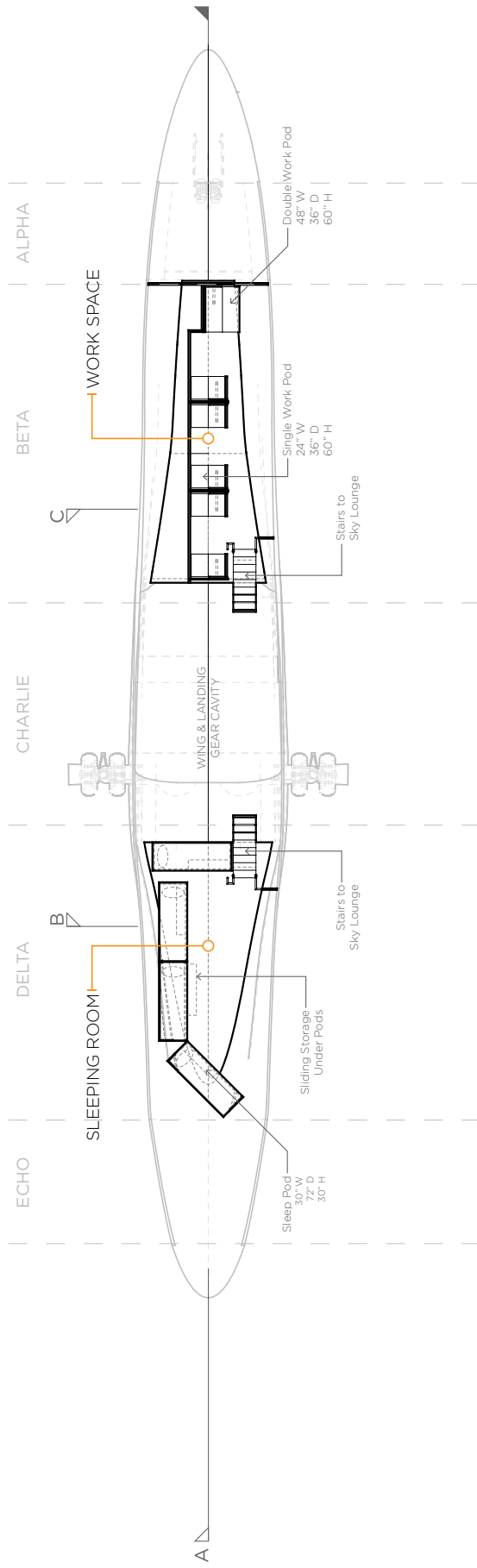
The newly redesigned Boeing 737-800 has been stripped of its dated amenities and cramped arrangement and refitted with a series of environments that serve a much happier passenger experience. Using the previous aircraft only for its chassis, the interior spaces have been flipped on end to create a new standard of flying that aims to challenge what we expect of our commercial airline providers.



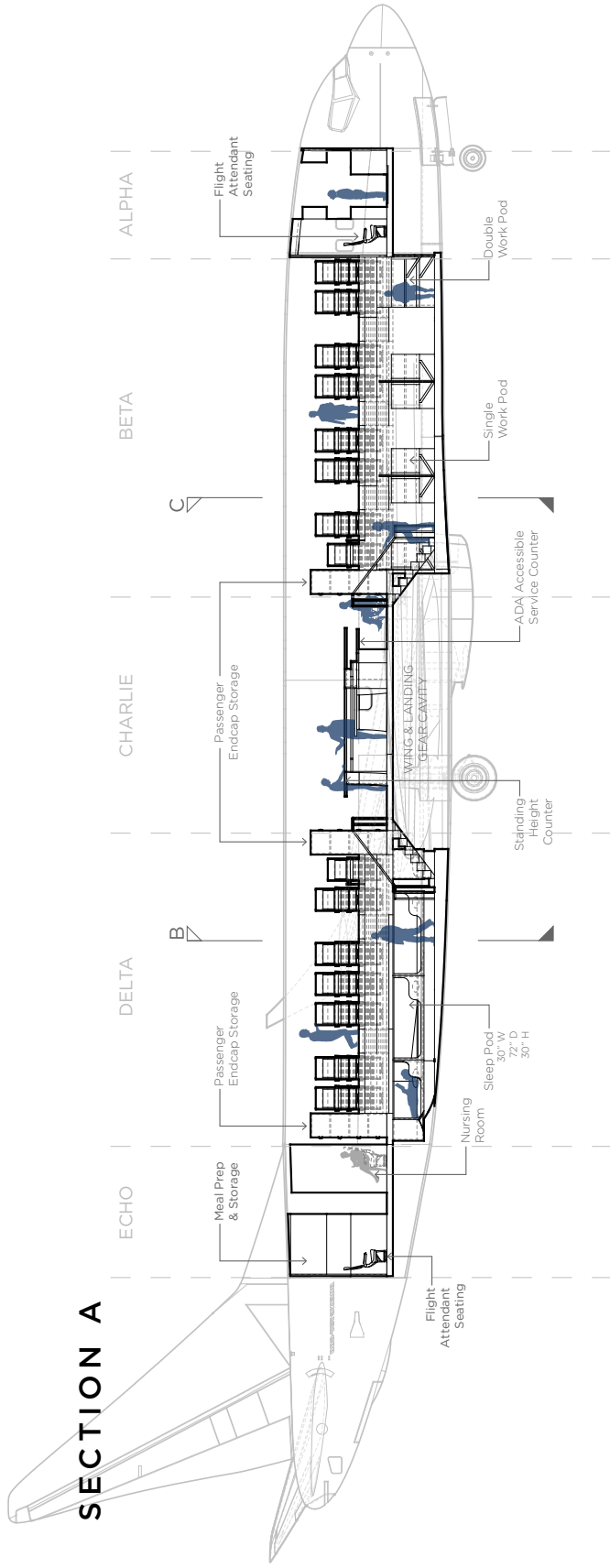


The main level is barely recognizable to the previous patron. Interchangeable modules throughout the new interior are as versatile as the ever-changing needs of it's passengers. With program separated by zones, spaces have been carved out of the main level for much larger restrooms, more spacious seating, a central sky lounge, additional onboard storage, even introducing a space for nursing mothers who need a private and sanitary environment.

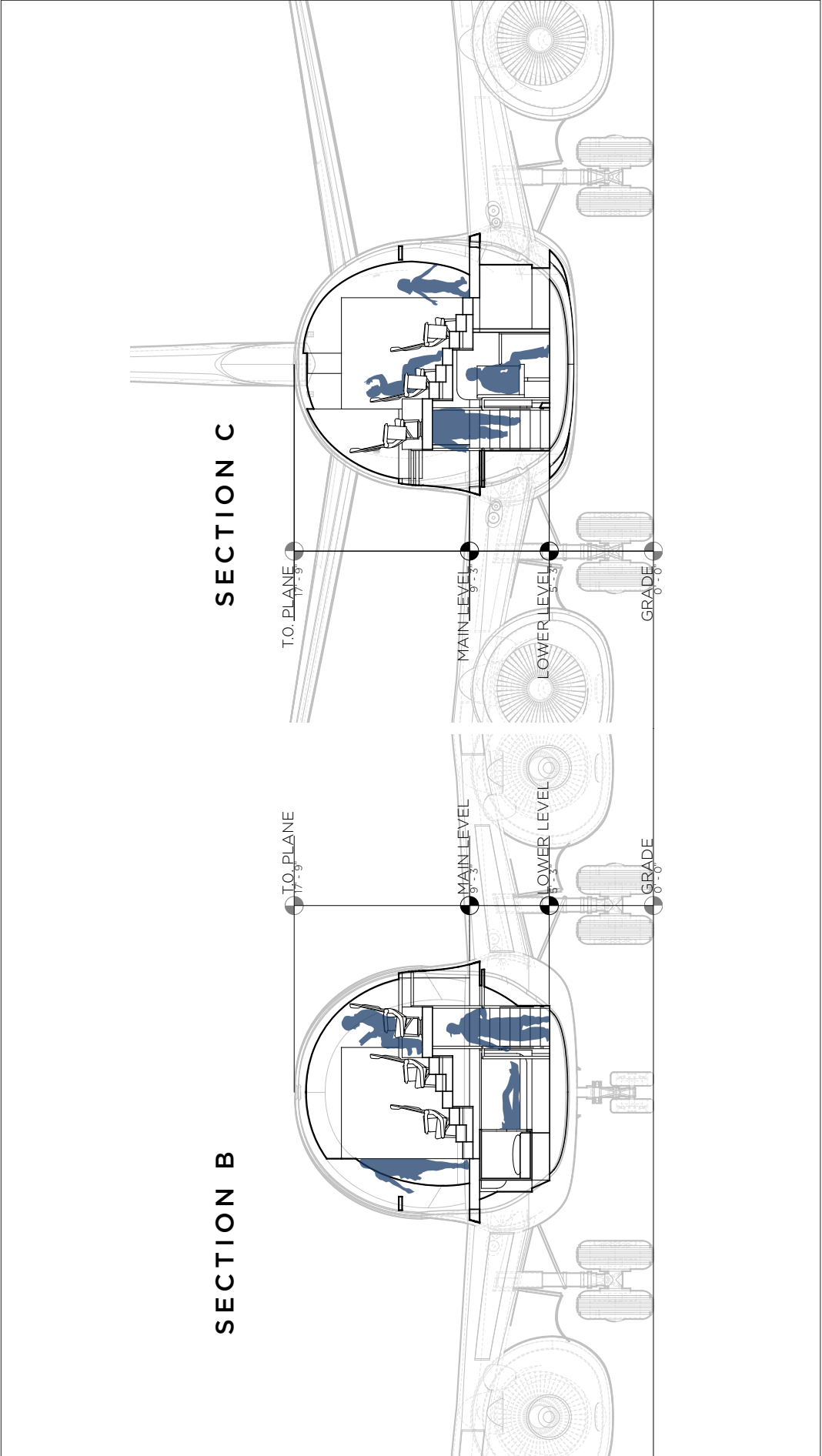
## LOWER LEVEL



With the need for the cargo hold eliminated, opportunity for exciting new spaces become available at the passengers disposal. The lower level of the Delta Zone has been equipped with sleep pods, sure to please the weary traveler. While towards the front, work pods beneath the Beta Zone allow small booths for work or play. Whether it be a business person crunching to meet a deadline on the go, or the everyday traveler just looking for a space to curl up with a good book, these pods make a great addition to the arsenal of amenities onboard my new 737.



While the lower core of the aircraft chassis has been left untouched due to placement of landing gear and integral wing structure, the remainder of the interior becomes a space to be explored rather than endured. Passengers are no longer confined to their seats for hours on end; destinations don't need to exist solely on land.

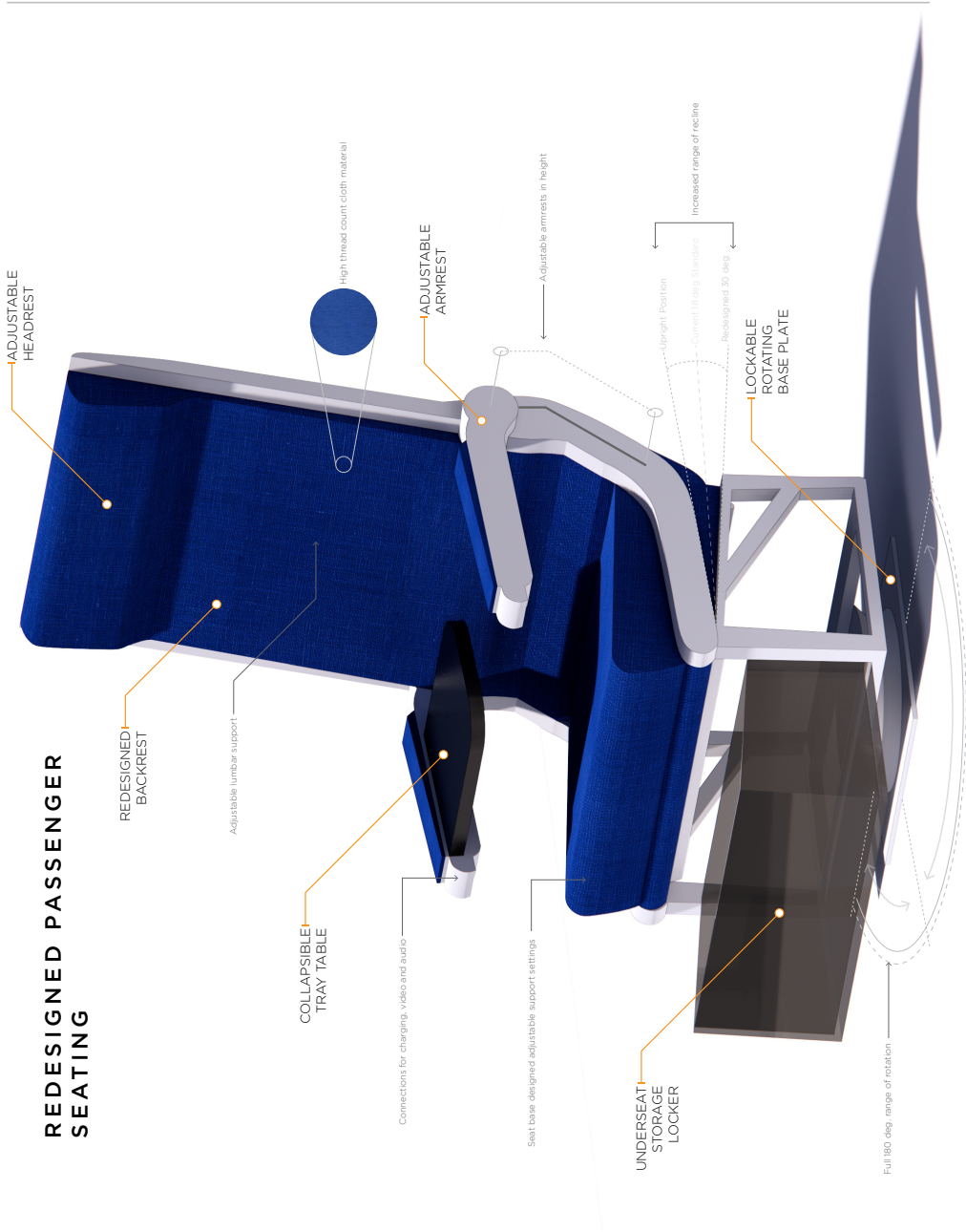


**SECTION B**

**SECTION C**

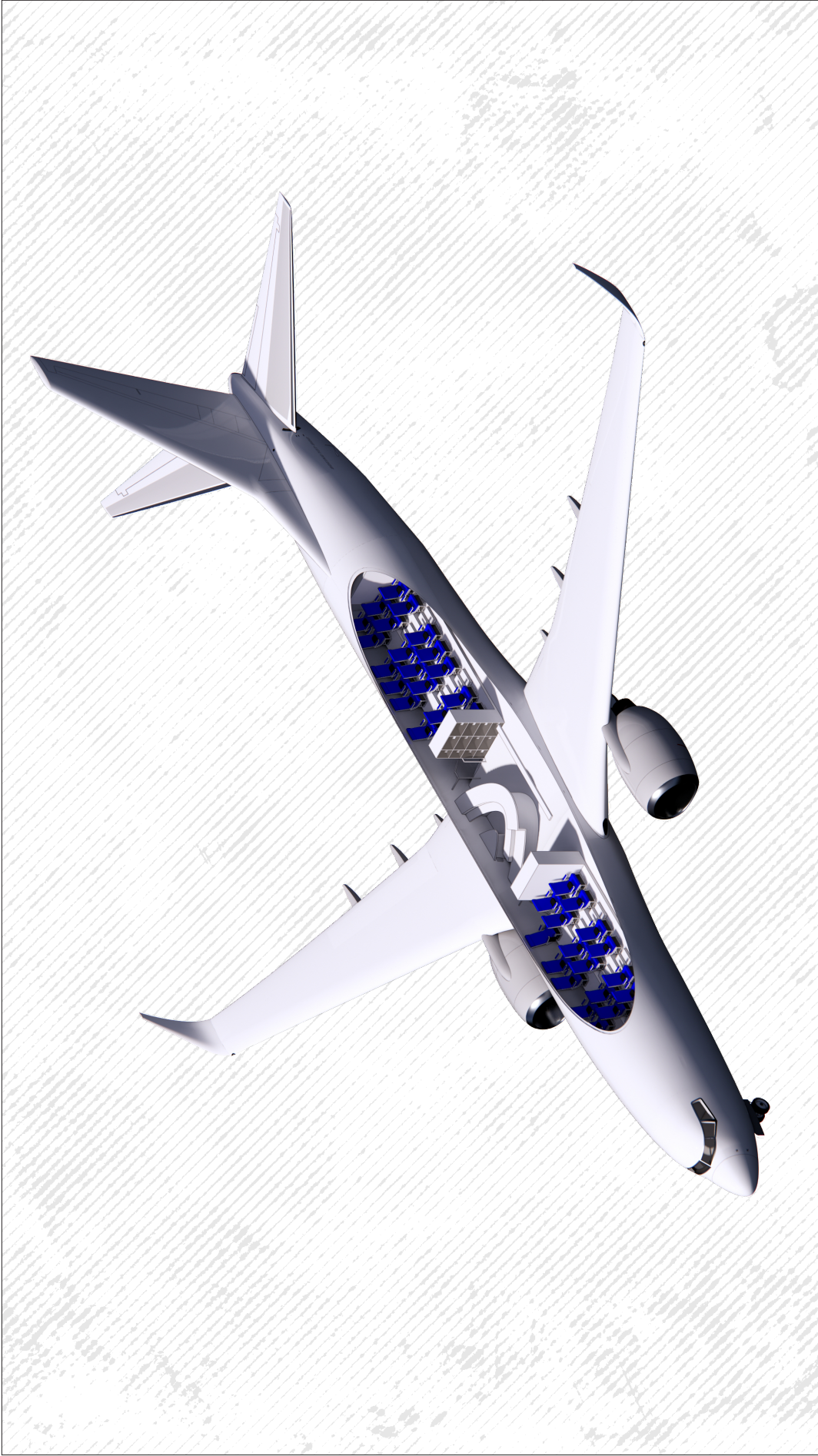
The gradual stepping of the seating modules has allowed for accessible head room in the lower level. Designing in section has allowed me to create exciting spaces in these tight volumes while still keeping the human scale in mind.

# REDESIGNED PASSENGER SEATING



One of the undeniable heavy-hitters when it comes to defining a positive passenger experience is how comfortable they are during their flight. I've redesigned the standard for aircraft seating using key components from its predecessor to minimize waste where available. This new seat has multiple fixed positions that it can rotate between, adjusting during various phases of the flight. Existing technologies that had previously never shown their face in air travel have been installed to increase customization to best fit the comfort of the passenger. Cutting down on the number of passengers onboard allows for more space for each individual, not only in floor space but in volume as well.





I want to leave you with a quote from Naked Airport, a book that helped open my eyes to the airline standards in a critical fashion. The author tells a story much like that of my own first experience at the airport. "I was unsettled for the rest of the drive home: my cousin's departure had been dreamlike and elusive, but at the same time, very real - the essential modern moment - when technology seemed perfectly in tune with human aspiration, before hijackings and air rage, before jumbo jets, before deregulation, dysfunctional baggage carousels, and electromagnetic scanners. Air travel had become an ordeal to be endured, not enjoyed. But I always wondered what happened in that brief interval between the perfect airport moment (...) and the disappointments of later years." (Alastair Gordon, 2004) I believe that my design would reignite the imagination of passengers, hoping to paint the essential modern moment in a picture that all can picture themselves within. I hope that each of you see yourself in my design, even picturing spaces that would like, but even more importantly dislike. The ability to constantly improve the built environment; in any form, is something that continues to push our community higher, faster, and to continue to design with our head in the clouds...in more ways than one.



01



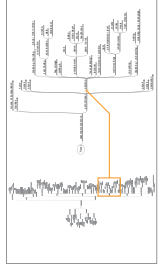
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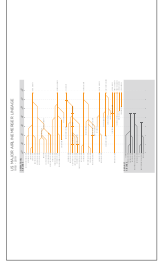
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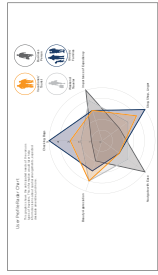
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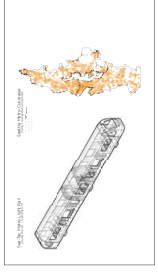
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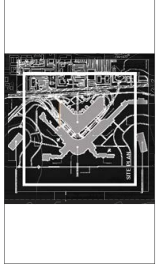
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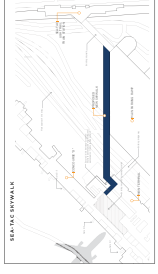
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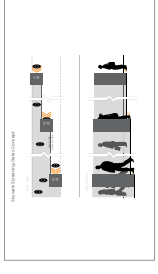
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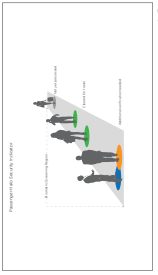
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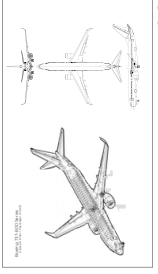
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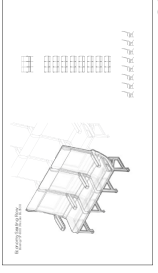
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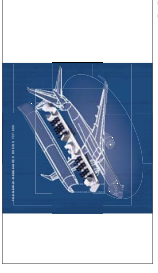
19



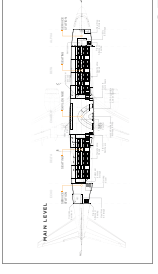
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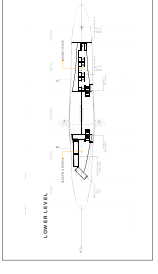
21



22



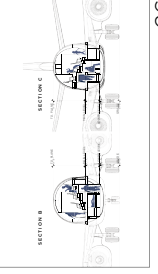
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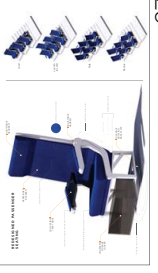
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26



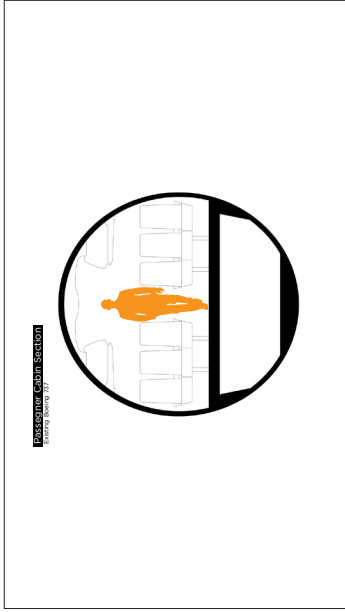
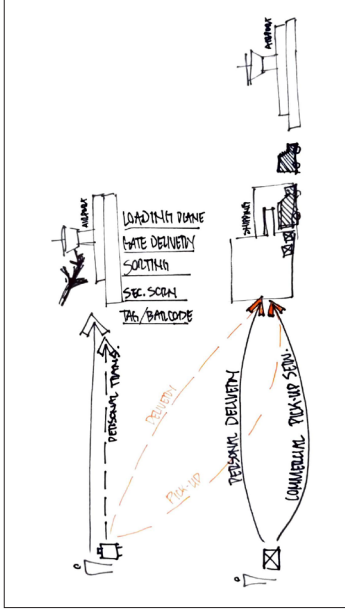
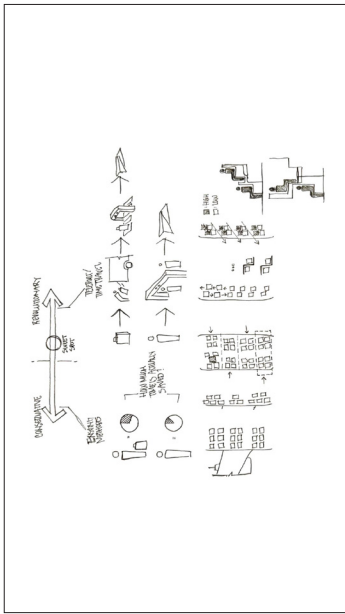
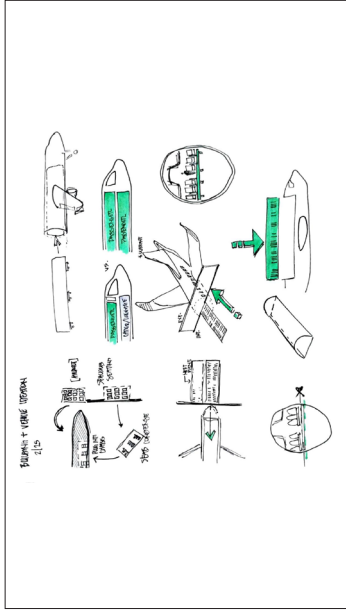
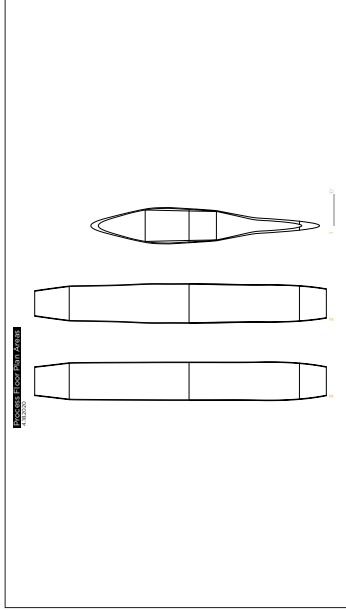
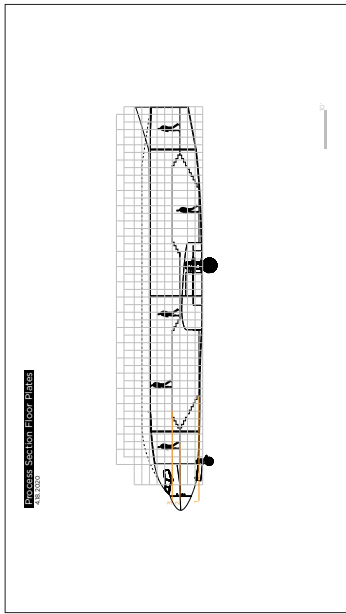
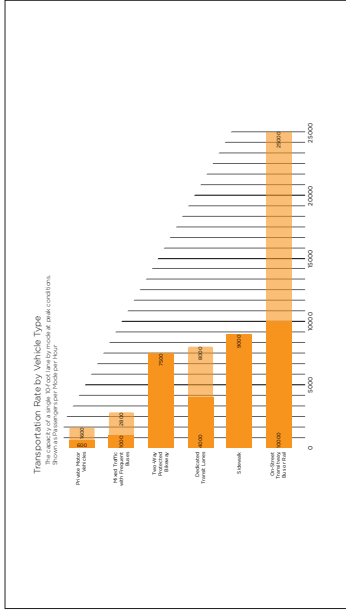
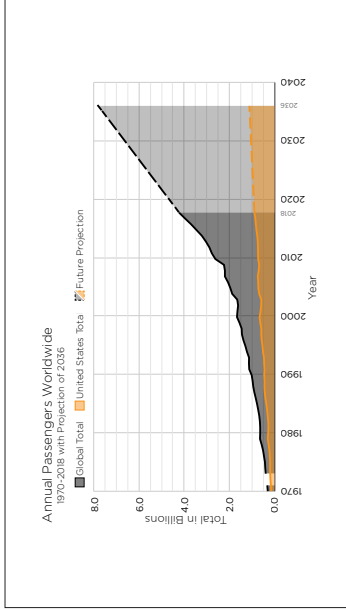
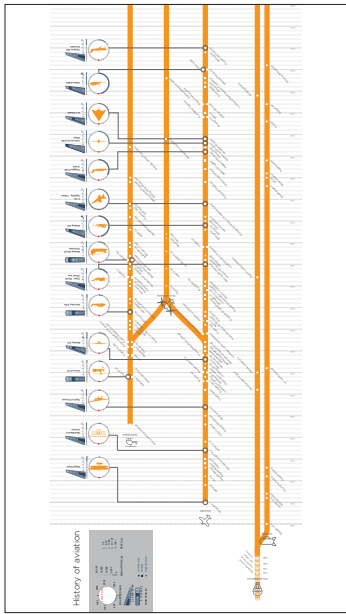
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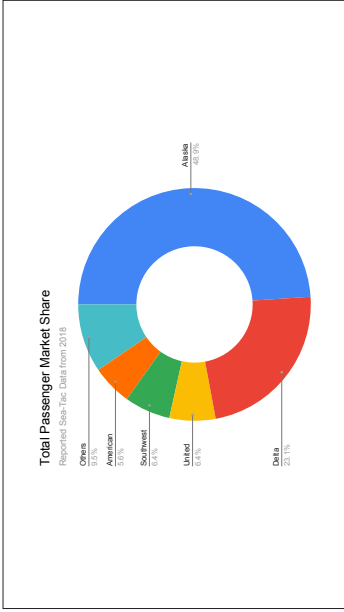
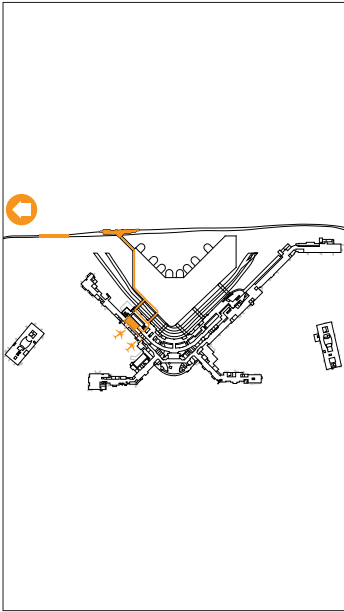
28

(A collective thumbnail view of all the slides in my presentation saved for the end for the critics reference.)





Several slides were attached to the end of the presentation to have them ready for reference in case critics asked to see process work, research results, or any supplementary info that was deliberately not included in the formal thesis presentation.

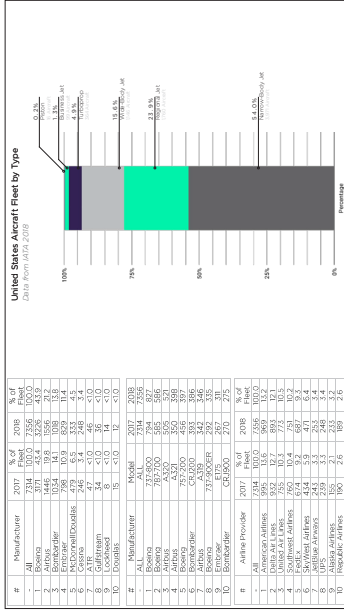


### Top 30 International Airports in the United States

Rank	Airports	City	State	2018	2017	2016
1	LAX	Los Angeles	CA	41,222,422	41,222,422	41,222,422
2	DFW	Dallas-Fort Worth	TX	37,111,111	37,111,111	37,111,111
3	ORD	Chicago	IL	36,555,555	36,555,555	36,555,555
4	ATL	Atlanta	GA	35,999,999	35,999,999	35,999,999
5	PHX	Phoenix	AZ	35,444,444	35,444,444	35,444,444
6	IAH	Houston	TX	34,888,888	34,888,888	34,888,888
7	MDW	Chicago	IL	34,333,333	34,333,333	34,333,333
8	DTW	Detroit	MI	33,777,777	33,777,777	33,777,777
9	SEA	Seattle	WA	33,222,222	33,222,222	33,222,222
10	PHO	Phoenix	AZ	32,666,666	32,666,666	32,666,666
11	LAS	Las Vegas	NV	32,111,111	32,111,111	32,111,111
12	DFW	Dallas-Fort Worth	TX	31,555,555	31,555,555	31,555,555
13	PHX	Phoenix	AZ	31,000,000	31,000,000	31,000,000
14	IAH	Houston	TX	30,444,444	30,444,444	30,444,444
15	MDW	Chicago	IL	29,888,888	29,888,888	29,888,888
16	DTW	Detroit	MI	29,333,333	29,333,333	29,333,333
17	SEA	Seattle	WA	28,777,777	28,777,777	28,777,777
18	PHO	Phoenix	AZ	28,222,222	28,222,222	28,222,222
19	LAS	Las Vegas	NV	27,666,666	27,666,666	27,666,666
20	DFW	Dallas-Fort Worth	TX	27,111,111	27,111,111	27,111,111
21	PHX	Phoenix	AZ	26,555,555	26,555,555	26,555,555
22	IAH	Houston	TX	26,000,000	26,000,000	26,000,000
23	MDW	Chicago	IL	25,444,444	25,444,444	25,444,444
24	DTW	Detroit	MI	24,888,888	24,888,888	24,888,888
25	SEA	Seattle	WA	24,333,333	24,333,333	24,333,333
26	PHO	Phoenix	AZ	23,777,777	23,777,777	23,777,777
27	LAS	Las Vegas	NV	23,222,222	23,222,222	23,222,222
28	DFW	Dallas-Fort Worth	TX	22,666,666	22,666,666	22,666,666
29	PHX	Phoenix	AZ	22,111,111	22,111,111	22,111,111
30	IAH	Houston	TX	21,555,555	21,555,555	21,555,555

### Top 30 International Airports in the United States

Rank	IATA Code	2018	Difference	% Change	2017	Difference	% Change	2016	Difference	% Change
1	LAX	41,222,422	0	0%	41,222,422	0	0%	41,222,422	0	0%
2	DFW	37,111,111	0	0%	37,111,111	0	0%	37,111,111	0	0%
3	ORD	36,555,555	0	0%	36,555,555	0	0%	36,555,555	0	0%
4	ATL	35,999,999	0	0%	35,999,999	0	0%	35,999,999	0	0%
5	PHX	35,444,444	0	0%	35,444,444	0	0%	35,444,444	0	0%
6	IAH	34,888,888	0	0%	34,888,888	0	0%	34,888,888	0	0%
7	MDW	34,333,333	0	0%	34,333,333	0	0%	34,333,333	0	0%
8	DTW	33,777,777	0	0%	33,777,777	0	0%	33,777,777	0	0%
9	SEA	33,222,222	0	0%	33,222,222	0	0%	33,222,222	0	0%
10	PHO	32,666,666	0	0%	32,666,666	0	0%	32,666,666	0	0%
11	LAS	32,111,111	0	0%	32,111,111	0	0%	32,111,111	0	0%
12	DFW	31,555,555	0	0%	31,555,555	0	0%	31,555,555	0	0%
13	PHX	31,000,000	0	0%	31,000,000	0	0%	31,000,000	0	0%
14	IAH	30,444,444	0	0%	30,444,444	0	0%	30,444,444	0	0%
15	MDW	29,888,888	0	0%	29,888,888	0	0%	29,888,888	0	0%
16	DTW	29,333,333	0	0%	29,333,333	0	0%	29,333,333	0	0%
17	SEA	28,777,777	0	0%	28,777,777	0	0%	28,777,777	0	0%
18	PHO	28,222,222	0	0%	28,222,222	0	0%	28,222,222	0	0%
19	LAS	27,666,666	0	0%	27,666,666	0	0%	27,666,666	0	0%
20	DFW	27,111,111	0	0%	27,111,111	0	0%	27,111,111	0	0%
21	PHX	26,555,555	0	0%	26,555,555	0	0%	26,555,555	0	0%
22	IAH	26,000,000	0	0%	26,000,000	0	0%	26,000,000	0	0%
23	MDW	25,444,444	0	0%	25,444,444	0	0%	25,444,444	0	0%
24	DTW	24,888,888	0	0%	24,888,888	0	0%	24,888,888	0	0%
25	SEA	24,333,333	0	0%	24,333,333	0	0%	24,333,333	0	0%
26	PHO	23,777,777	0	0%	23,777,777	0	0%	23,777,777	0	0%
27	LAS	23,222,222	0	0%	23,222,222	0	0%	23,222,222	0	0%
28	DFW	22,666,666	0	0%	22,666,666	0	0%	22,666,666	0	0%
29	PHX	22,111,111	0	0%	22,111,111	0	0%	22,111,111	0	0%
30	IAH	21,555,555	0	0%	21,555,555	0	0%	21,555,555	0	0%



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# THESIS APPENDIX

## Reference List:

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Spatial Problem Solving: Corgan Studies Intuitive Wayfinding. (n.d.). Retrieved October 2, 2019, from <https://www.corgan.com/story/spatial-problem-solving-corgan-studies-intuitive-wayfinding/>.

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# PERSONAL IDENTIFICATION

**Mitchell A. Musel**

Degree Masters of Architecture



*Figure 30 | Personal Identification*



# PREVIOUS STUDIO EXPERIENCE

## SECOND YEAR

Fall Semester: Cindy Urness

Tea House // Fargo, North Dakota

*Site analysis and integration into building design*

Montessori School // Fargo, North Dakota

*Program driven building design for educational environment*

Spring Semester: Charlott Greub

Dwelling Project // Cripple Creek, Colorado

*Micro-housing design accomodating user specific needs*

Birdhouse // Fargo, North Dakota

*Design a home for a particular bird in the style of a Pritzker Prize winning architect*

## THIRD YEAR

Fall Semester: Regin Schwaen

Refuge Project // Nekoma, North Dakota

*Adaptive reuse of an abandoned nuclear missile base*

Lakeside Retreat // Nevis, Minnesota

*Responding to real clients design requests for a lakeside cabin*

Spring Semester: Bakr Aly Ahmed

Affordable Housing Complex // Fargo, North Dakota

*Design for community engagement through civic design*

Innovation Campus // Fargo, North Dakota

*Makerspace conceptualization using leftover space in the urban fabric*

## FOURTH YEAR

Fall Semester: Don Faulkner

Urban High Rise // Miami, Florida

*Capstone production of sustainable urban skyscraper on a tight schedule*

Spring Semester: David Crutchfield

Marvin Windows Competition // Fargo, North Dakota

*Residential design catered to the available window types of a specific vendor*

Mortal Engines City Design // Fargo, North Dakota

*Urban planning and design based on principles of fictional film 'Mortal Engines'*