The Futures of Flight

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Abstract

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This thesis contends that imagination and visions of the future have been present throughout the history of human flight. Events of the past have continuously changed perceptions of possibility in flight and have subsequently expanded the limits of imagination. As these limits expand a number of potential futures arise. Once a futuristic fantasy, flight has become commonplace in modern society. Unfortunately, the formerly romantic experience of flying has become increasingly mundane as demand for commercial air travel grows. Struggling to keep up with an increasing number of passengers, spaces to support flight, namely airports, have focused on growth and efficiency, further diminishing the common experience of flight. The emergence of Vertical Takeoff and Landing (VTOL) aircraft, however, represents one potential future with the opportunity to enhance the human relationship with flight. This thesis proposes a regional infrastructure system of 'skyports' to support VTOL within the state of Washington. One skyport design in particular is developed in the town of Snohomish, WA. The design seeks to foster a positive experience of flight, create a direct relationship to the sky, and use unique natural and built environments to imagine where the futures of flight can possibly go.

THE FUTURES OF FLIGHT

Thank you to my family, friends, and professors.

What’s done is done.

TABLE OF CONTENTS

fig. 1 Dove in Flight

1

INTRODUCTION

> *The light dove, in free flight cutting through the air, the resistance of which it feels, could get the idea that it could do even better in airless space. Likewise, Plato abandoned the world of the senses because it posed so many hindrances for the understanding, and dared to go beyond it on the wings of ideas, in the empty space of pure understanding. He did not notice that he made no headway by his efforts for he had no resistance, no support, by which he could stiffen himself, and to which he could apply his powers in order to get his understanding off the ground.*
>
> *Immanuel Kant*[1]

The story of human flight has needed resistance. The resistance of impossibility to find new possibilities. The condition of the earth to define the condition of the sky. A grounded existence to imagine the ability to fly. It has required an understanding of the earth to transition to the realm of the sky. To get understanding off the ground. Where the limits of flight and the extents of imagination continue to expand.

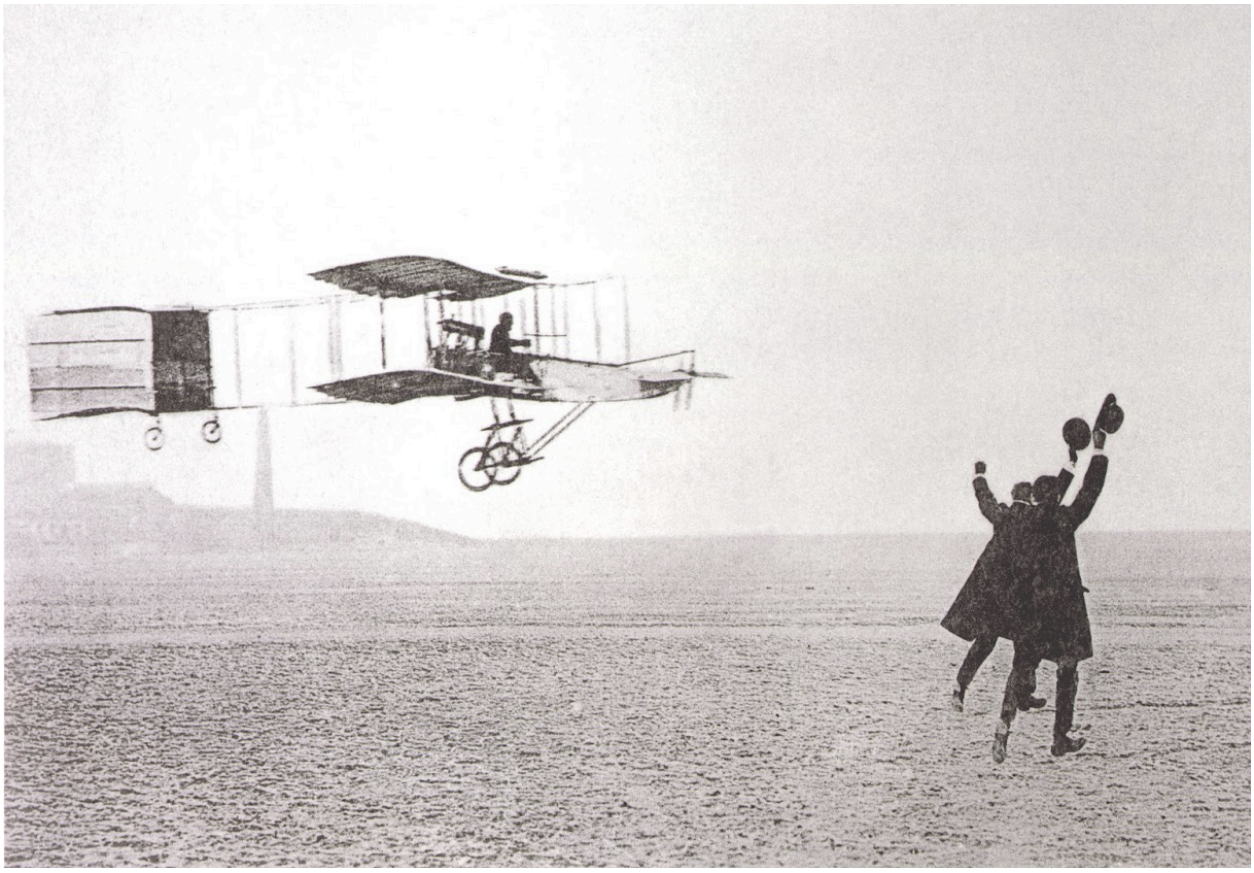


fig. 2 Farman Aeroplane, 1908

This thesis explores imagination as way to promote possibility within the potential futures of our time. These futures are examined through the lens of human flight, the physical embodiment of imagination, where the ability to fly is both literal and metaphorical. New potentials for the futures of flight are sought as a means of expanding the understanding of what is possible and what can be imagined.

Several ideas will be employed to formulate a framework for this thesis. First, the human imagination will be explored through theories posed by a number notable philosophers. The dualities which inform imagination will be analyzed, primarily the relationships between productive and reproductive, mental and physical, fiction and reality. Second, the creation of past narratives which connect separate historical events will be analyzed and applied to important events connecting humans and flight. This will be used to set up, third, an analysis of future narratives and their implications on the many possible futures of flight. In combination, these three explorations will ultimately be used to inform the proposed project of this thesis.

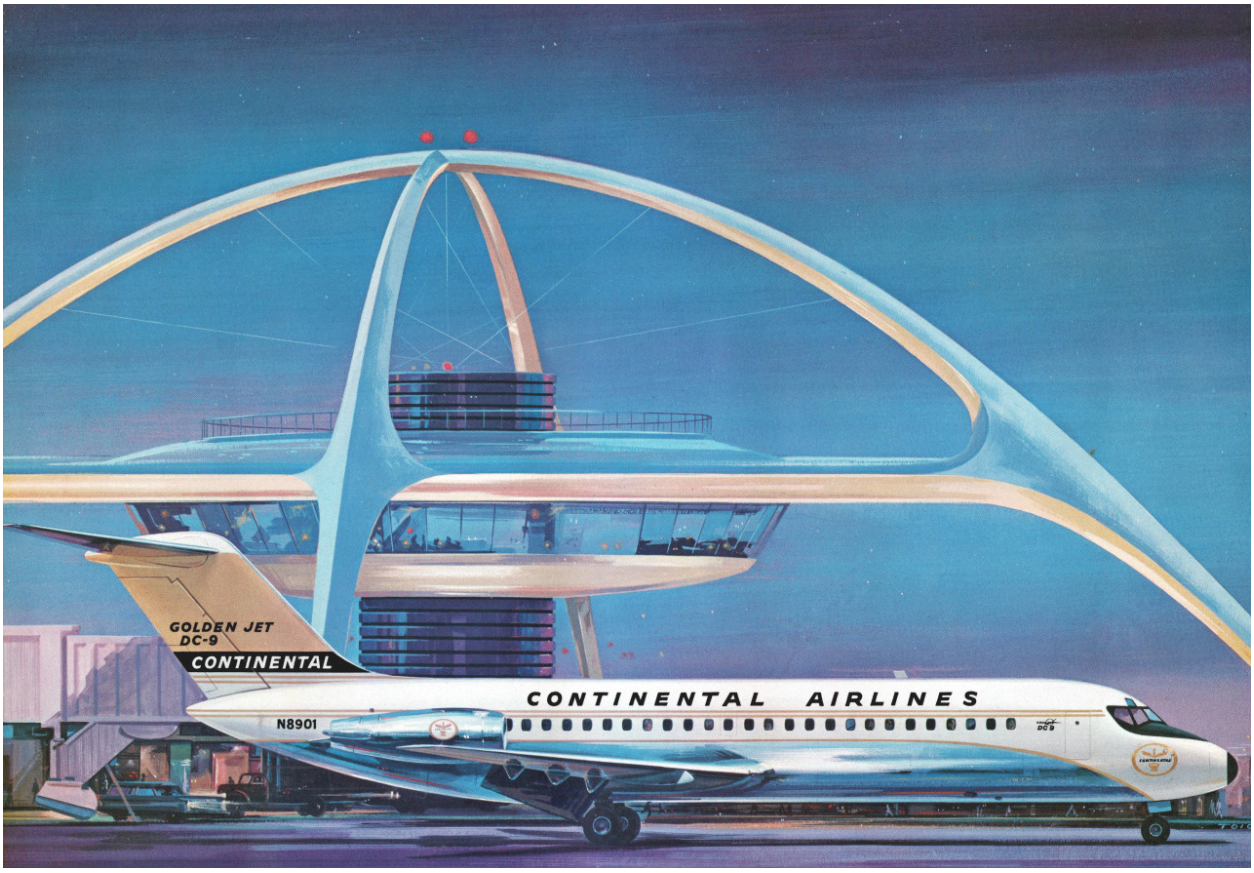


fig. 3 Formerly Romantic Visions of Commercial Flight

The past events of humans and flight can be viewed as a story. A story where romantic experiences of flying and visions of possible futures have been documented since early mythology. Unfortunately, this story has led to a point in time where the common experience of flying has lost those once romantic visions. This thesis continues the tradition of imagining futures and looks to establish ways in which the human relationship with flight can be enhanced. It will utilize new modes of air transportation that have the potential to provide a different type of accessibility to the sky and connect to unique environments on the ground.

Vertical Takeoff and Landing (VTOL) is an emerging aircraft typology that will likely become readily available in the coming decades. Several beneficial factors including their small size, minimal required landing space, energy efficiency, and projected use as ride-share vehicles present an opportunity to establish a new relationship with flight that promotes a positive experience of flying and fosters new forms of imagination. There is, however, no existing infrastructure to support VTOL as a viable means of air transportation. Current design proposals do exist but they have primarily focused on urban areas as locations where they might be used most frequently.

fig. 4 CityAirbus VTOL Prototype

The project this thesis proposes uses the established framework to imagine a potential future where places beyond solely urban areas have access to VTOL vehicles. Places where flight can begin to exist, connecting locations through the sky that are currently only connected on the ground. The goal of the project is to enhance the relationships between humans, flight, and their place on earth. The project looks to create direct thresholds between the earth and sky. Places where architecture can play a role. Specific to VTOL infrastructure, these thresholds are called skyports. In contrast to conventional airports, skyports reflect the small scale of VTOL aircrafts and offer a direct vertical connection to the sky. The project explores Washington state as an area with unique environments where a regional system of skyports could exist. It then identifies Snohomish, WA as a viable location to implement a design for one proposed skyport. The skyport design represents one possible location and one potential future among many others. Ideally this future has the potential to expand the understanding of what is possible and what can be imagined.

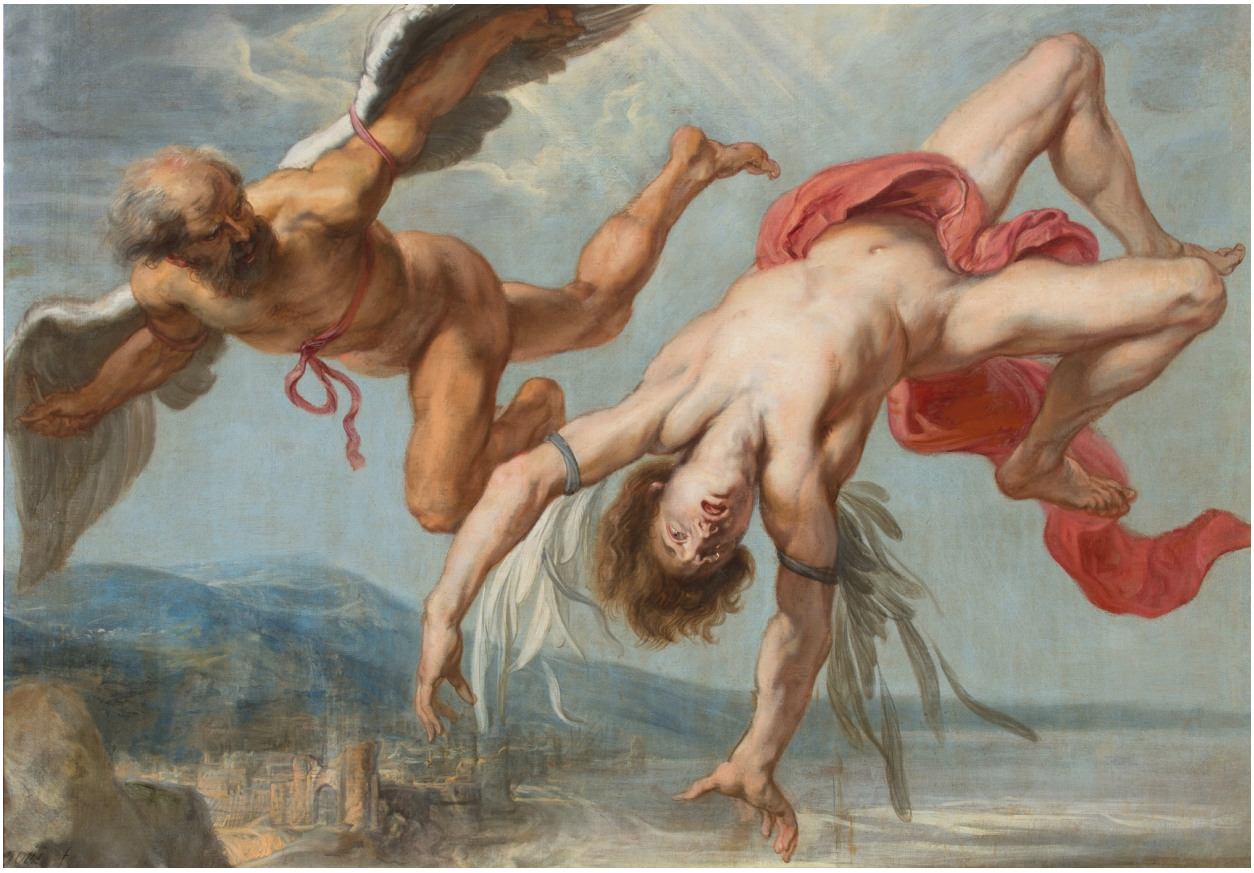


fig. 5 The Fall of Icarus

2

THE STORY OF FLIGHT

Whatever the mind clearly conceives includes the idea of possible existence...Nothing we imagine is absolutely impossible...We can form no idea of a mountain without a valley, and therefore regard it as impossible.

David Hume[2]

Flight is inescapably linked to the imagination. It is both a metaphorical example and a physical byproduct of it. The sky is analogous to the mind as the earth is to the body. Common phrases such as 'head in the clouds' or 'the sky is the limit' suggest the sky is where imagination exists. Where physical limitations give way to mental explorations. Where imagination has the space to expand and the ability to fly. Imagination is also what enabled humans to literally fly. While the body did not necessitate the evolution of wings, the mind developed an ability to think beyond the seemingly impossible. For centuries humans have conceived visions of flying. When connected these visions tell a story — the story of human flight. This story began long before flight became a reality and has led to our current point in time. From here the story will continue with a multitude of potential futures. Imagination, like flight, has expanding possibilities and expanding futures. Futures that should be explored further.

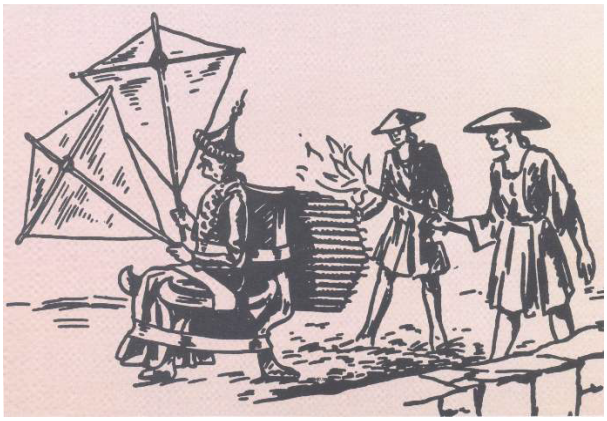


fig. 6-9 Emperor Shun, King Kay Kavus, King Bladud, Alexander the Great

"I warn you, Icarus—limit your flight to the region between heaven and earth."

Daedalus[3]

The earliest documented imaginations of flight come from early mythology. One of the most well-known is the Greek myth of Icarus and Daedalus with an oral history believed to stretch as far back as 3500 BC. In the 2nd century AD, the Roman poet Ovid is the first to document the tale in written form. The story tells of the architect-inventor Daedalus designing wings of feathers and wax for him and his son Icarus to escape the island of Crete.[4] Icarus, despite his fathers warning, flies too high in the sky causing the wax on his wings to melt from the heat of the sun. Stripped of his wings, Icarus subsequently falls to his death (*fig. 5*).

The story, like others of classical mythology, is a cautionary tale where the sky is deemed a realm for the gods while humans are relegated to the earth.[5] Other myths that support this tell of kings and emperors who, akin to immortal gods, could fly. Examples include the Chinese Emperor Shun from the 23rd century BC, the Persian King Kay Kavus from the 11th century BC, the Briton King Bladud from the 9th century BC, and most familiarly the Macedonian King Alexander the Great from the 4th century BC (*fig. 6-9)*.[67]

The fate of Icarus, a mortal, was meant to resist others from letting their imaginations fly too high. Despite these early tales, humans have continued to be fascinated by the dream of flying.

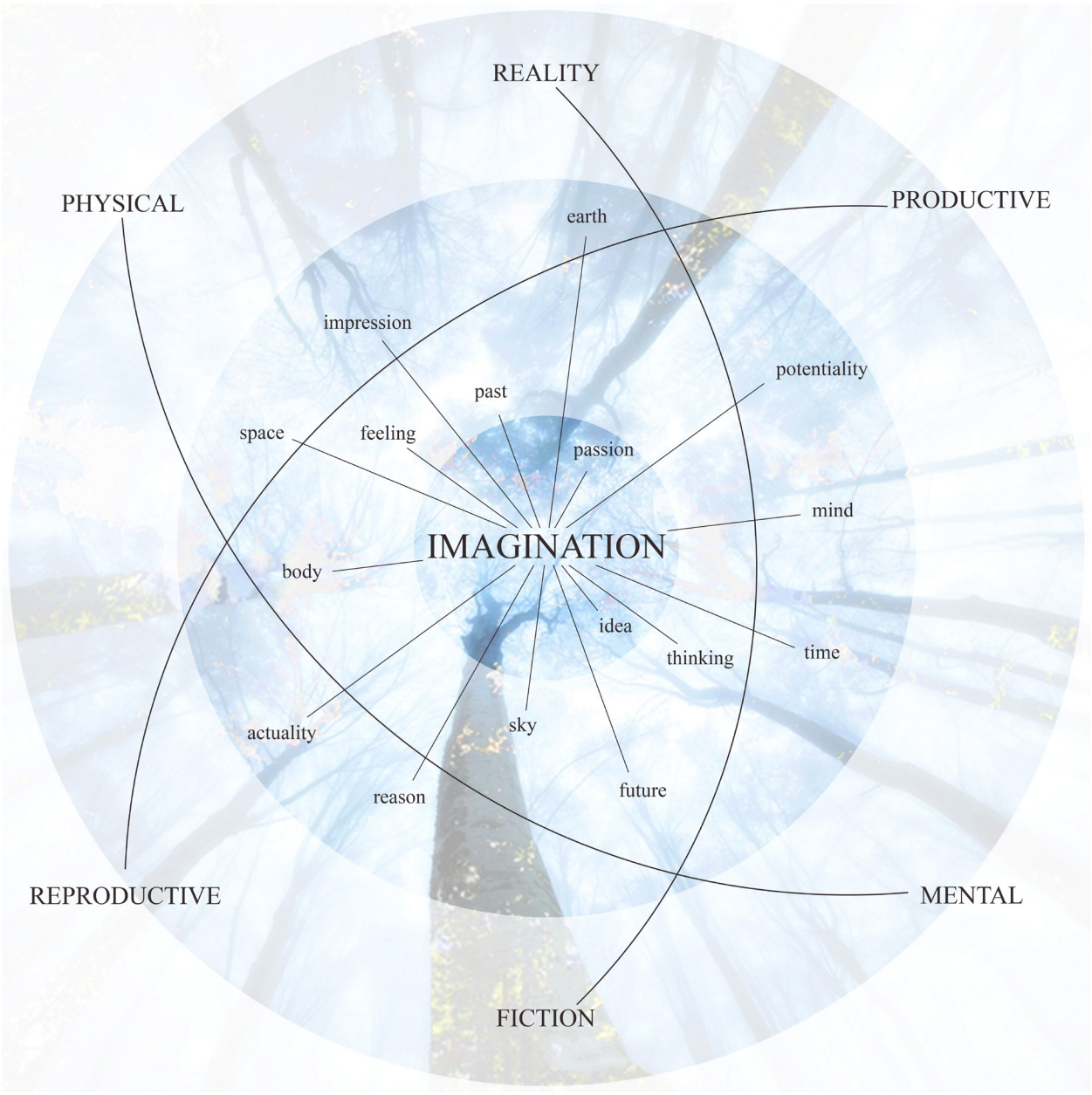


fig. 10 Sphere of Imagination

IMAGINATION

The word *imagination* is commonly used to explain what may exist in the mind but does not exist physically. It is often a vision that is purely fictional or a possible reality of the future. Imagination has been investigated as a theory and its generally accepted concepts stem from Enlightenment philosophers such as Immanuel Kant who defined imagination as "the faculty for representing an object even without its presence in intuition".[8] This suggests that the common use of the word is generally in line with its true meaning. Kant and others have unpacked the concept even further. Their explorations have found that imagination is informed by several dualities such as mind and body, thoughts and feelings, passion and reason, impressions and ideas, feeling and thinking, earth and sky, past and future, space and time, potentiality and actuality.

These sub-dualities fall within three pairs of larger dualities 1: productive and reproductive, 2: mental and physical, 3: fiction and reality. Each pair will be further investigated through the writings of Immanuel Kant, David Hume, and Paul Ricoeur. In conjunction, these dualities are analyzed in order to create a representational framework for this thesis. Their combination forms a sphere of imagination (*fig. 12*). Like the possibilities that come with flight, the sphere of what can be imagined is continually expanding.

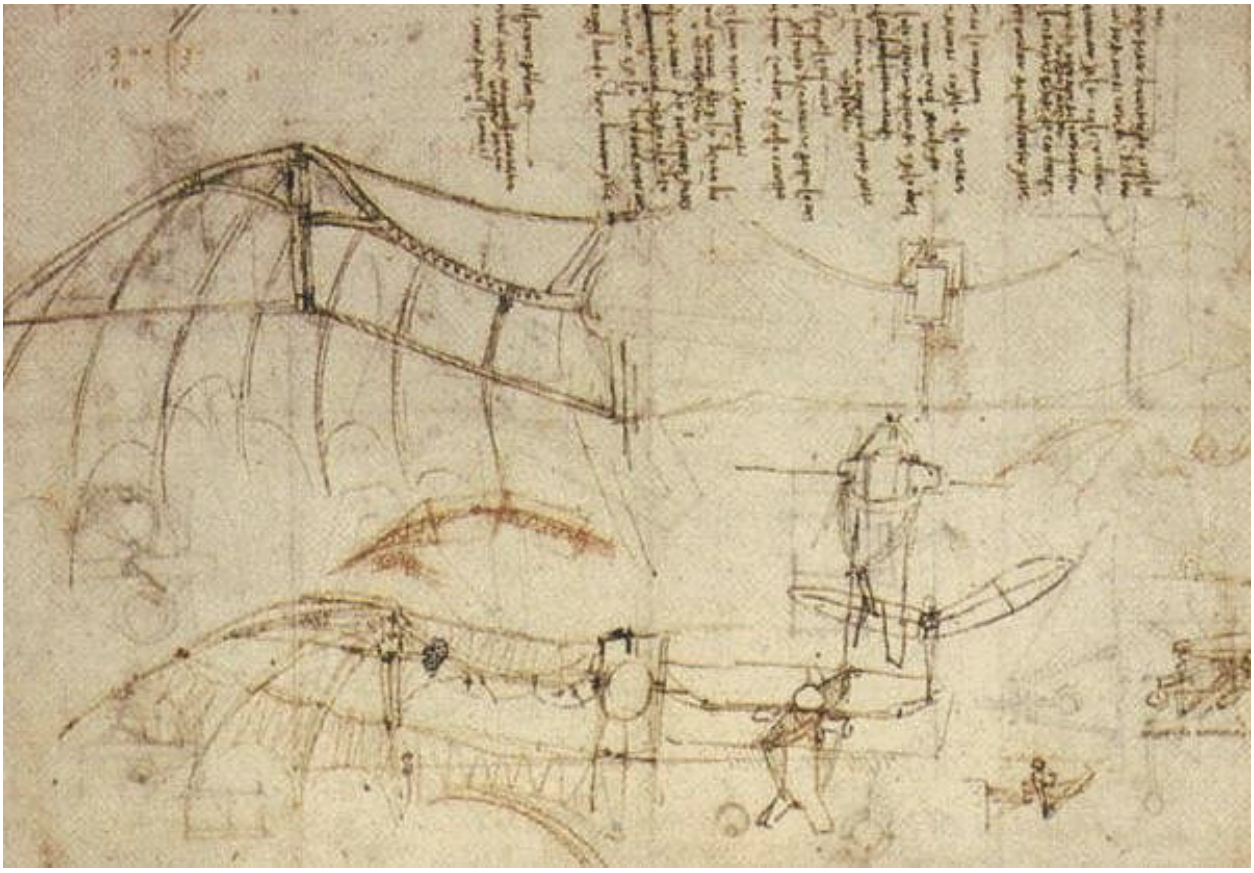


fig. 11 Leonardo da Vinci Glider Drawings

But you who live in dreams—are you better pleased by the false reasoning and cheating that goes on when great and uncertain things are discussed than by things which are sure and natural and not so far beyond our grasp?"

Leonard da Vinci[9]

The story of human flight has been driven by passion and approached with reason by those like Leonardo da Vinci. Similar to generations of people before him, da Vinci was captivated by the notion of flight, he however made real strides towards its actualiztion. Upon observing and documenting birds in flight, he found that the same physical principles of aerodynamics and lift could be applied to humans. Da Vinci's notebooks are filled with drawings and descriptions of proposed flying machines (*fig. 11*).[10] Despite being born nearly five hundred years before the invention of the airplane, he strongly believed that flight could one day be achieved.

It is unclear whether da Vinci ever tested his designs, but he was not alone in his belief in making flight a reality. Several others throughout history have attempted to take to the sky in rudimentary flying machines such as Abbas ibn Firnas of Spain in the 9th century AD, the Montgolfier Brothers of France first balloon flight in 1783 AD, Sir George Cayley of England in the early 19th century, and Otto Lillienthal of Germany in the late 19th century (*fig. 12-15*).[11]

After countless experiments, fantasies of flight eventually bridged into the world of reality. With a combination of imagination, willpower, and technological innovation, thinkers like Leonardo da Vinci translated the false reasoning of human flight into a sure and natural possibility.

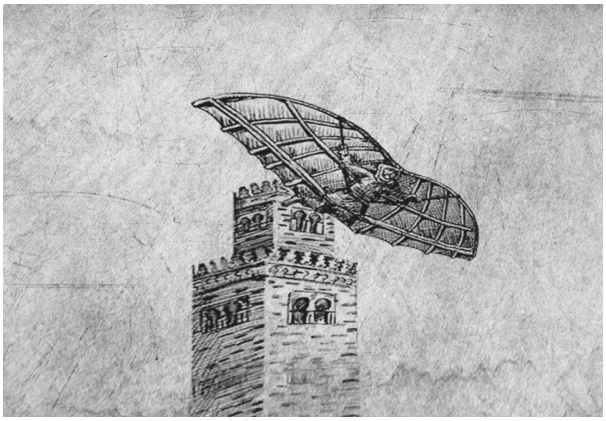


fig. 12-15 Abbas ibn Firnas, Montgolfier Brothers, Sir George Cayley, Otto Lillienthal

PRODUCTIVE AND REPRODUCTIVE

Productive and reproductive imagination are two highly theorized concepts among philosophers. Immanuel Kant was one of the first to discuss these concepts at length. Kant's interest in imagination was likely instigated by the period in which he worked, the Age of Enlightenment. At the time the scientific method established critical reason as a predominant mode of thinking. Kant, however, believed that intuition and creativity were important concepts that could not be quantified by reason.

Through a series of lectures and texts Kant defines *productive* imagination as "a faculty of the original presentation of the object (*exhibitio originaria*), which thus precedes experience".[12] This describes productive imaginations as entirely new ideas not informed by anything known or perceived to be known. Essentially 'out of thin air'. This concept is especially important to Kant because it does not stem from or result in any empirical evidence. Interestingly it begs the question of whether or not a seemingly original imagination does exist. The flip-side of this concept is *reproductive* imagination which Kant defines as "a faculty of the derivative presentation of the object (*exhibitio derivativa*), which brings back to mind an empirical intuition that it had previously".[13] This suggests that reproductive imaginations are reinterpreted or repurposed from what is already known.

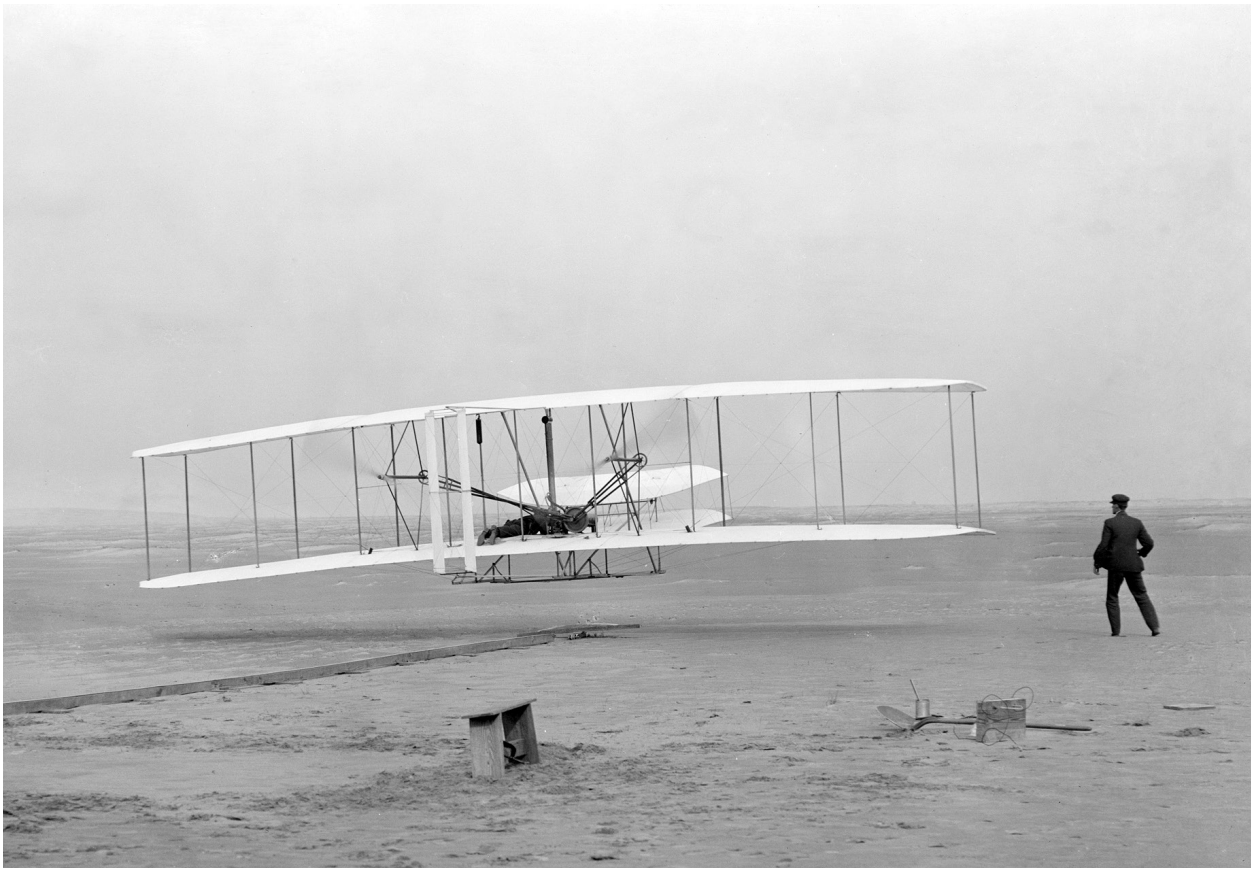


fig. 16 The Wright Brothers First Flight

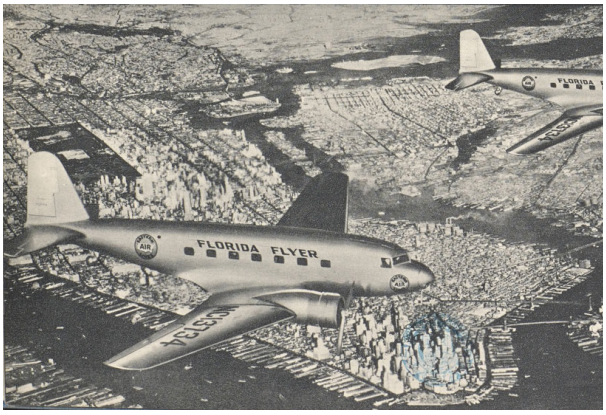
You cannot discredit truth merely because legend has grown out of it. The sometimes almost godlike achievements of our own species in ages past toddle through history supported more often than not on the twin crutches of fable and human credulity.

Beryl Markham[14]

Human flight is no longer an impossibility. Imaginations of flight have continuously pushed the limits of what is conceivable through productive and reproductive cycles. The story of flight has been a story of ideas, each building off one another. Eventually those ideas reached a point where flight was achieved.

It only took twelve seconds for Orville and Wilbur Wright to suspend reality (*fig. 16*).[15] The first pilot-flown powered flight forever altered the relationship between humans and the sky. It redefined impossibility and sparked the imaginations of generations that followed. The sky has become a space for both spectacle and destruction. It has seen both wing-walking in the early 19th century and military aircraft patrolling the skies throughout several wars (*fig. 17-18*).

The capability of flight and access to the sky has also provided an expanded understanding of the earth. Upon one of his first flights, the well-known architect Le Corbusier noted in his book *Aircraft*: "the eye now sees in substance what the mind formerly could only objectively see" (*fig. 19*).[16] Flight has enabled new perspectives and with it new possibilities that go even beyond the sky. In less than seventy years, the perceived resistance of impossibility went through its most drastic transformation as humans went from twelve seconds of flight, twenty feet above the ground, to landing Neil Armstrong and Buzz Aldrin on the Moon in 1969 (*fig. 20*).



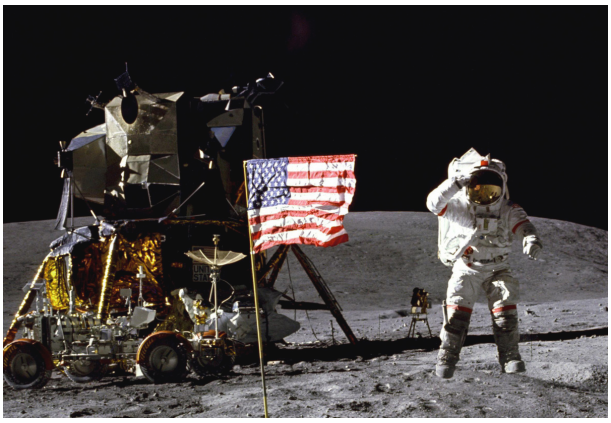


fig. 17-20 Tennis on a Plane, Vietnam War Helicopters, Le Corbusier's 'Aircraft', Moon Landing

FICTION AND REALITY

The duality between productive and reproductive can be further understood with the addition of fiction and reality. Paul Ricoeur, analyzes the concept of fictional imagination as a mode of shaping reality. He suggests that these dualities are more fluid than binary, implying perceptions of imagination can change over time.

Ricoeur describes *fiction* as "absent from the actualities with which we deal in everyday life under the mode of empirical control and manipulation".[17] He suggests that fiction requires a critical consciousness or belief in non-existence. *Reality*, on the other hand, implies a critical consciousness distinguishing what exists from what does not. Interestingly, Ricoeur believes that these dualities can inform one another. In his writings, he proposes that fiction has the capability to change reality, stating that the former can both "invent" and "discover" the latter.[18] Further, he proposes that Kant's concept of productive imagination plays a role in transitioning between the two realms: "imagination is 'productive' not only of unreal objects, but also of an expanded vision of reality. Imagination at work - in a work - produces itself as a world".[19] Ricoeur suggests productive imagination can refer to both fiction and reality. He believes that by developing imagination through physical "work" the perception of reality becomes fluid. If also applied to reproductive imagination, these two dualities form a tangential relationship to one another.

Imaginations fall in a range between productive and reproductive as well as fiction and reality createing a dynamic field where dualities work in relation to one another.

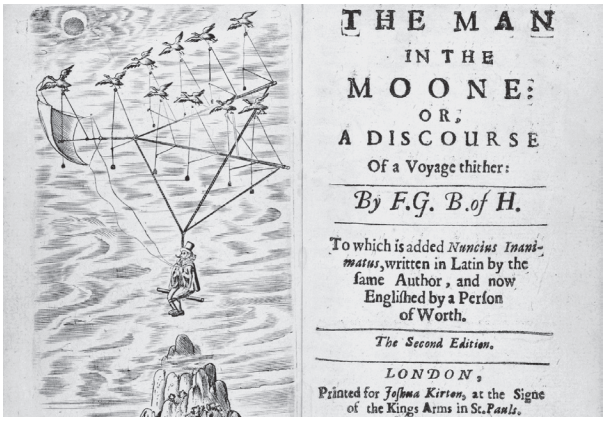
fig. 21 J.M. Barrie's Peter Pan

The moment you doubt whether you can fly, you cease forever to be able to do it. The reason birds can fly and we can't is simply that they have perfect faith, for to have faith is to have wings.

J.M. Barrie[20]

Known as the creator of the popular literary and film character Peter Pan, Barrie is one of many authors to invoke dreams of flying (*fig. 21*). Within the fantasy realm, the wonderment of flying is metaphorically used to induce the aspirations of an audience where fantasy becomes truth.

Flight has become firmly ingrained within cultural identity. Barrie and other authors have written fantasy novels involving humans and flight such as Frances Godwin's 1638 novel *The Man in the Moone* (*fig. 22*).[21] As human flight has evolved, depictions in other developing mediums have arisen as well. It is seen in television shows like *The Jetsons*, film, particularly science fiction films like *Blade Runner,* and art from those like Lebbeus Woods (*fig. 23-25*).[22] These depictions commonly show fantastic visions or visions of the future clearly demonstrating the link between flight and capturing the public imagination. They provide the opportunity to look beyond the world of reality and find inspiration in the sky.



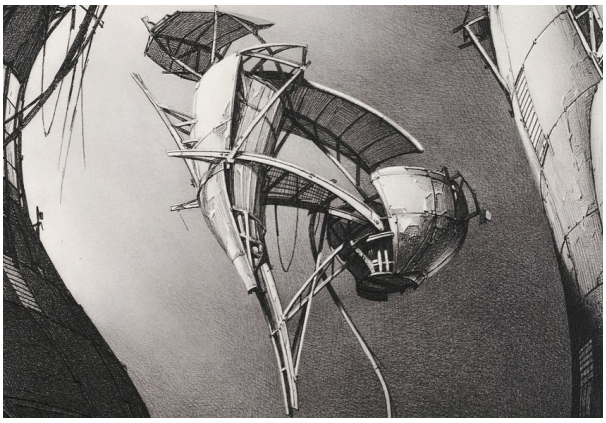


fig. 22-25 The Man in the Moone, The Jetsons, Blade Runner (2049), Photon Kite

MENTAL AND PHYSICAL

Both Kant and Ricoeur acknowledge the mental and physical aspects of the human imagination but a key addition to this discussion is another enlightenment philosopher, David Hume. In a similar vein as Kant, he believed that reason should not be a predominant force, instead asserting that "reason is, and ought only to be the slave of the passions."[23] Hume's work addresses the mental and physical realms where the creation of complex perceptions inform imagination.

In Hume's view perceptions are the internal and external sum of impressions characterized by "sensations, passions, and emotions"[24] as well as "thinking and reasoning".[25] He asserts that "any impression, either of the mind or body, is constantly followed by an idea, which resembles it, and is only different in the degrees of force and liveliness".[26] This enforces the concept that imagination exists both the *mentally* and *physically*. It is more than just a cognitive function of the mind. The body acts as a threshold between the mental and physical realms, each constantly informing and shaping one another. The interplay of mental and physical perceptions is reminiscent of other dualities working tangentially with one another.

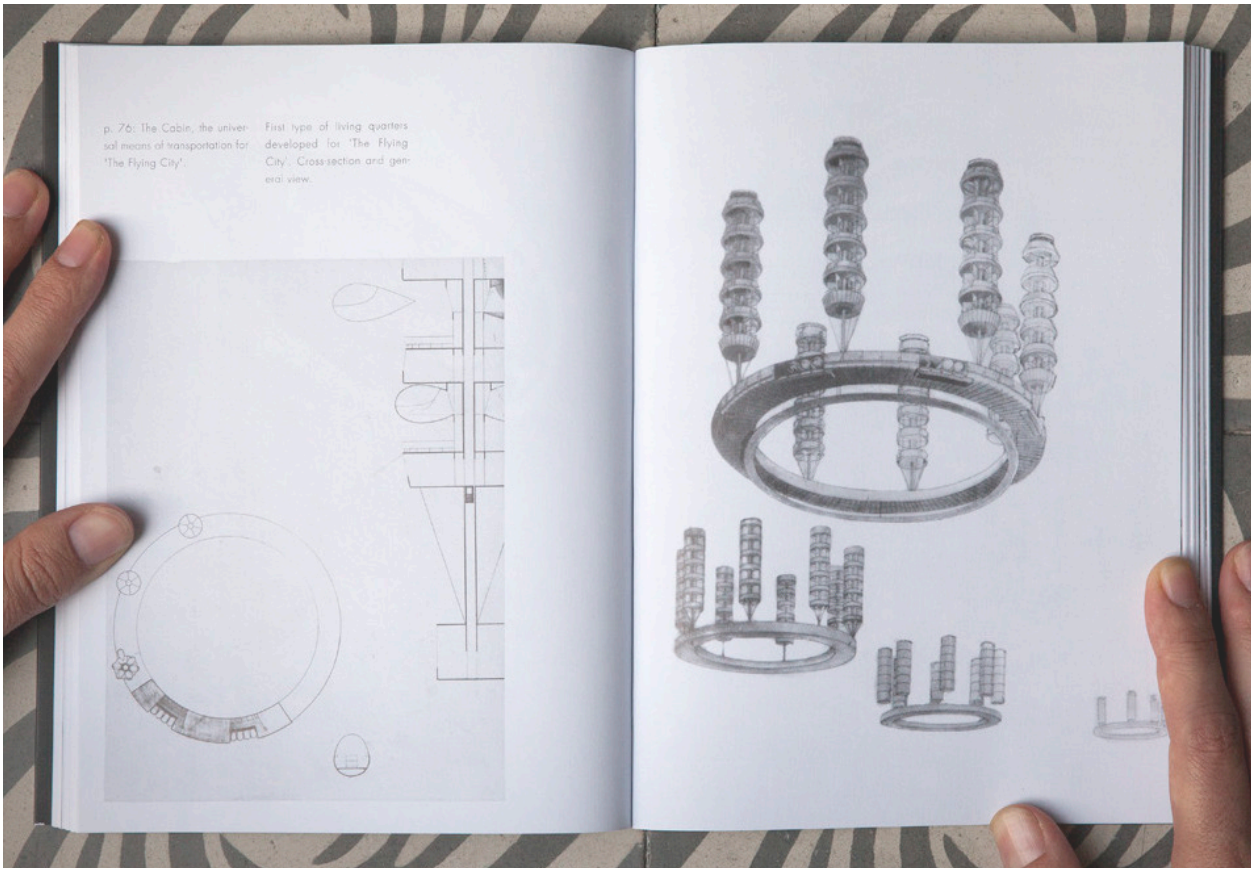


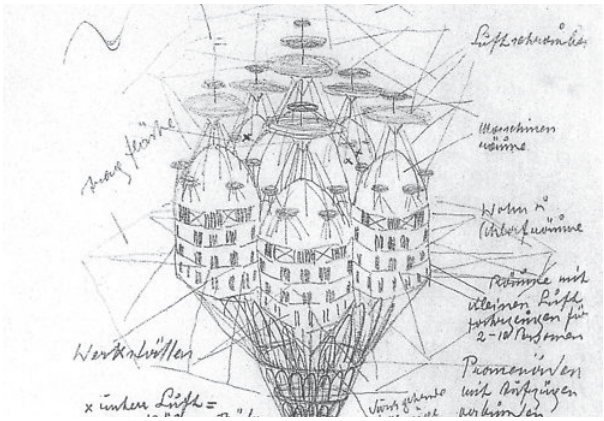
fig. 26 City of the Future

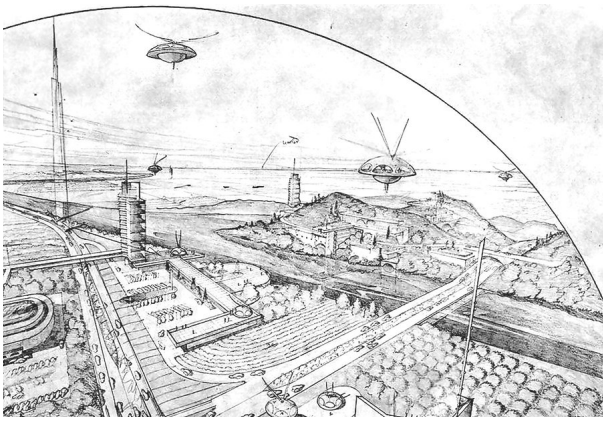
The fight for the architecture of the future is the fight of today.

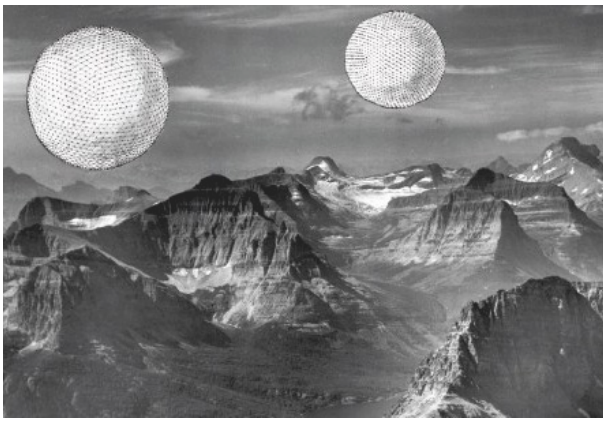
Georgii Krutikov[27]

Flight and visions of the future have not only been seen in popular media but also through the eyes of visionary architects. Many have speculated possible relationships between the sky, the earth, and the built environment. Following the Russian Revolution in the early 20th century, several students at the avant-garde Vkhutemas school in Moscow were among those who dreamt of a future in the sky. One of these students, Georgii Krutikov developed a radical thesis proposing that architecture could exist in the sky (*fig. 26*). He believed the sky could become a space to live while the earth remained as a space for agriculture and industry. In his proposal, Krutikov references "dreamers of the past" with seemingly far-fetched ideas whose ideas eventually became reality. He understood that imagination did not have to be relegated to realities of the present but could instead rely on unknown possibilities of the future.[28]

Others like Krutikov have been inspired by the possibilities of the future and the opportunity of flight to expand the limits of imagination. Examples include Wenzel Hablik's 1908 *Floating Colonies*, Frank Lloyd Wright's 1932 *Broadacre City*, Buckminster Fuller's 1960 *Cloud Nine*, and Peter Cook's 1969 *Instant City.*[29] All of these proposals demonstrate architectural speculations that find relationships between past and future, actuality and potentiality, fiction and reality. Elements of which can be realized or used to inspire future imaginations.







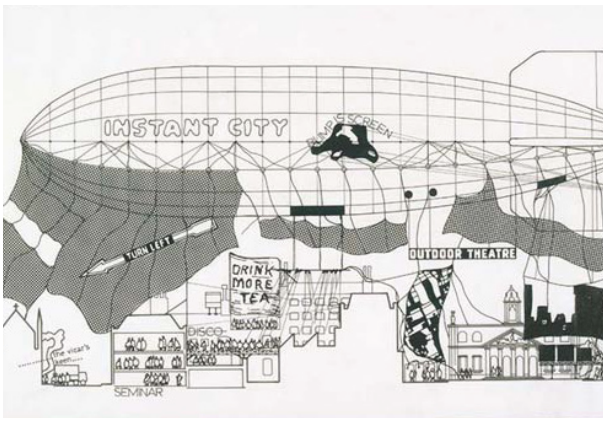


fig. 27-30 Floating Colonies, Broadacre City, Cloud Nine, Instant City

THRESHOLD

Imagination does not exist as one duality or another. This has been established. Instead it has a fluidity and exists within a range of multiple dualities with the potential to be perceived differently over time. The relationship between these dualities is where the strongest imaginations lie. Relationships that form thresholds where newly produced ideas become reproduced, where the mental realm translates into the physical, and where fiction bridges the world of reality. When combined, these relationships form a sphere of imagination. And like the possibilities that come with flight, this sphere of what we can imagine is constantly expanding.

As a sphere of reciprocal dualities, imagination obtains an abstract and spatial understanding only changed through the advent of time. Seeking an understanding between space, time, and imagination, Hume again takes an interesting standpoint. He observed that "in the course of our thinking, and in the constant revolution of our ideas, our imagination runs easily from one idea to any other that resembles it".[30] This suggests that imagination should not solely be thought of as a re-purposing of the present. Hume likens our constantly changing perceptions to the ways in which imagination should be employed. He believed that as physical or conceptual objects change, sensory understanding of those objects change as well, further proclaiming that "the imagination must...acquire the same method of thinking, and run along the parts of space and time in conceiving its objects".[31] Imaginations constantly change and they must be understood in a way that allows for that change.

There is no permanence in time and there is no permanence in imagination. A *threshold* between dualities allows for the imagination to understand what is productive or reproductive, mental or physical, fiction or reality. Allows it to find new resistance, new possibilities, new futures.

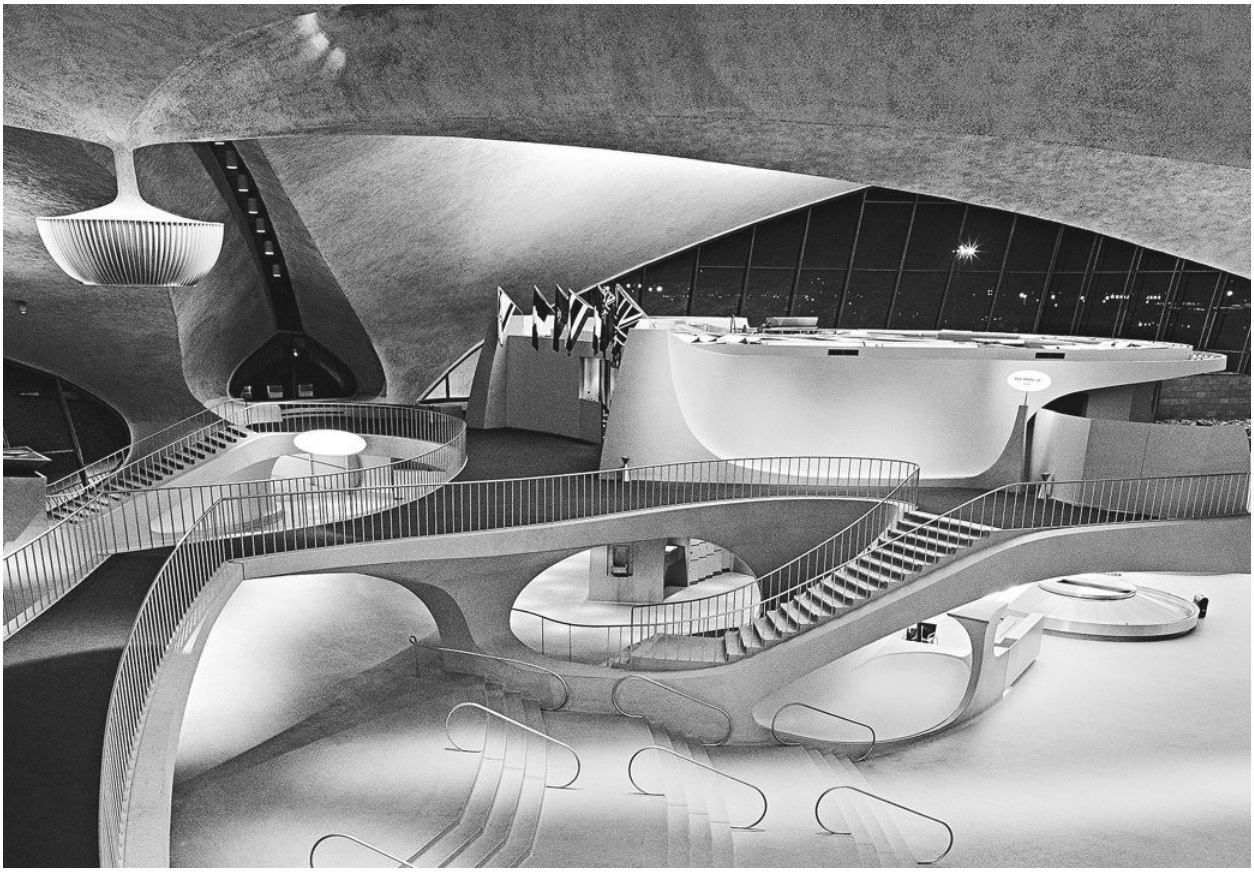


fig. 31 TWA Terminal at JFK Airport

The act of imagination...is a magical act. It is an incantation designed to make the object of one's thoughts, the thing one desires, appear in such a way that one can take possession of it.

Jean-Paul Sartre[32]

The ability to fly has been preceded by a long story before it. The period of time following its actualization has been relatively short but has also seen the most change. Since that time it has become increasingly popular and available to the public. Flight is now commonplace, with aircraft flying all across the world. While architectural speculations have arisen, so have architectural realizations. Architecture is now relied upon to support the human will to fly and spaces like airports are built to support those who fly.

Eero Saarinen's TWA terminal at JFK Airport in New York City is reminiscent of what is referred to as 'the Jet Age' of flight and in 1962 it was built to support the growing popularity of commercial air travel.[33] The building was meant to both serve and inspire. Saarinen, like many others, was inspired himself by the streamlined and aerodynamic appearance of Jet Airliners. This is evident in the terminal's curvilinear forms fluidly moving the eye and the body through the space (*fig. 31*). It was born in a time when the most romantic visions of flight persisted in the public imagination. Flight, which forever altered perceptions of time and distance, now provides the ability to travel to places through the sky that were formerly only connected by the earth. Places connected through architecture.

Architecture holds a special place in the story of flight. It is conceived from the human imagination and stands between the earth and the sky. Where that which is above and that which is below meet, allowing the inhabitation of both realms.

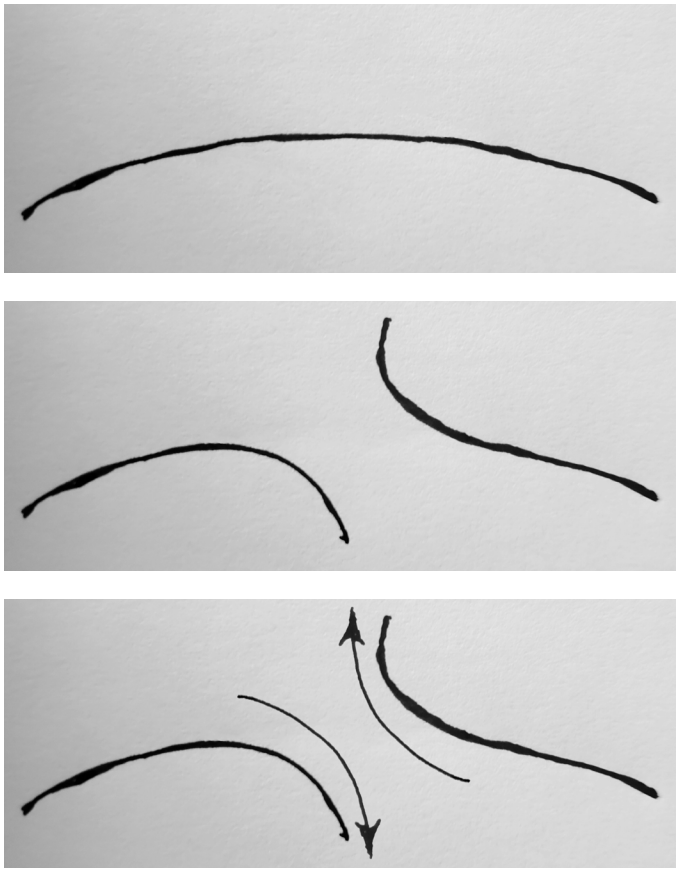


fig. 32 Threshold Between Earth and Sky

EARTH AND SKY

Imagination is located at the threshold of dualities. Their relationships make them strong. The earth and the sky are a similar duality and their connection is a threshold where flight allows the capability to transition from one realm to the other. Like imagination, the earth and the sky form a powerful relationship at this threshold.

Flight is uniquely capable of altering perceptions of space and time. The *sky* itself has been important throughout human existence for demonstrating the passage of time.[34] The capability of flight has also resulted in an expanded sense of the world and the connections between places have become increasingly complex. The *earth* is no longer a single point of resistance.[35] Bodies can physically transition to places that formerly only the mind could conceive. To passengers aboard an aircraft flying can feel as if is "not us how moved, but rather place that flowed around us."[36] This makes the connection between the earth and the sky all the more relevant. Where a proper threshold is needed. Where the earth peels up and the sky reaches down (*fig. 31*).

That threshold is where architecture plays its role. It is the physical embodiment of imagination. The space where new relationships and new possibilities can be found. Where the earth is the necessary resistance to reach the sky.

fig. 33 Line of Airplanes on a Runway

3

THE CONTINUUM OF FLIGHT

Thank god men cannot fly yet, and lay waste to the sky as well as the earth. We are safe on that side, for the moment!

Henry David Thoreau[37]

Time has enacted its influence. Humans can fly. Up until the current point in time, the story of flight is a past narrative with several important events marking its progression. The over-arching narrative has been reliant on those who have actively imagined what will come next. Visions that are capable of transcending both space and time.[38] A number of those envisioned futures have come to fruition, while many more have not. Both are a part of the story—a story that continues into the present. Merely achieving flight was not enough, with time new resistance will be faced. The story of flight is now presented with several future narratives that have ever-expanding possibilities. Continuing the tradition of imagining the futures of flight is important for promoting those possibilities and preserving the unknowns to come. Where impossibility lies and imagination persists.

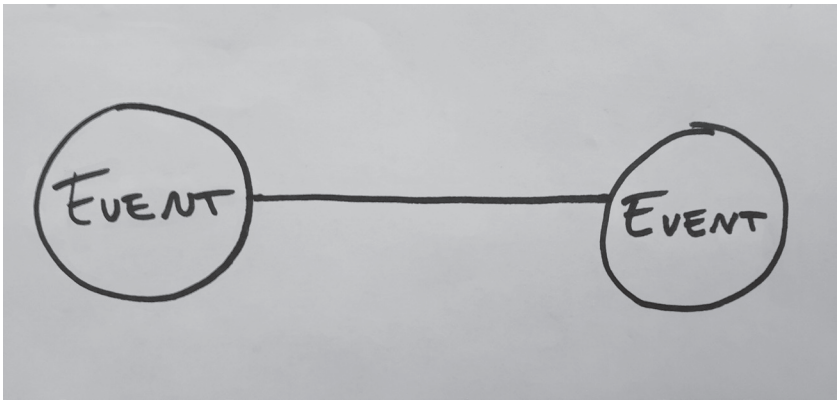


fig. 34 Past Narratives

PAST NARRATIVES

Narratives combine time and storytelling. The literary scholar Christoph Bode presents the concept of past narratives by first describing the reason why narratives themselves are important. In his view "they are meaning-creating devices, they make sense out of life, the universe and everything".[39] Bode proposes that the meanings sought while crafting narratives are a product of human nature. People seek to understand events not in isolation but instead by connecting them to one another in cause-effect relationships. When events are connected they become a narrative, without the connection there is no conceivable meaning.

Further Bode suggests that narratives of *past* events are the most familiar. They "endow events with meaning by discursively aligning them with other events".[40] This sets up a linear relationship of time and events where one event leads to the next (*fig 34*).

Up until this point in time, the story of flight has been a complex series of past narratives (*fig 35*). Looking backwards it is possible to find common threads between events. It is also possible to see how events from the distant past have perpetuated throughout history and into the present. Seemingly disconnected events form meaningful relationships. Icarus led Leonardo da Vinci, led to the Wright Brothers, led to J.M. Barrie, led to Georgii Krutikov, led to Eero Saarinen, led to today.

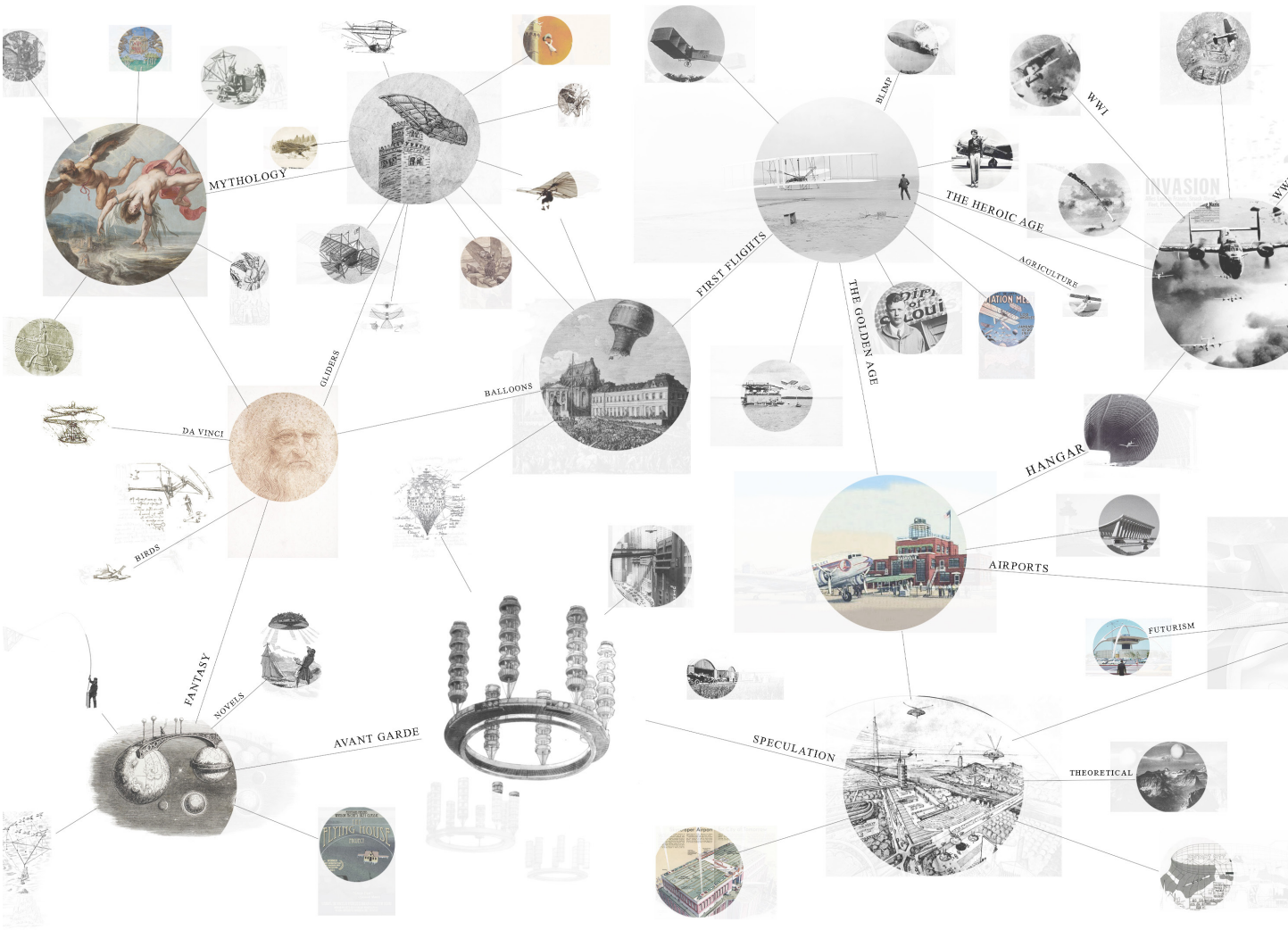


fig. 35 The Story of Flight


FUTURES
SPACE RACE
ROCKETS
TEST PILOTS
TERROR
DRONES
HUBS
RECREATION
COMMERCIAL
THE JET AGE
ARCHITECTURE
UNIT THEORY
MODERNISM
VTOL
FILM
TELEVISION
SCIENCE FICTION
TIME
StarTrek
MAVERICK

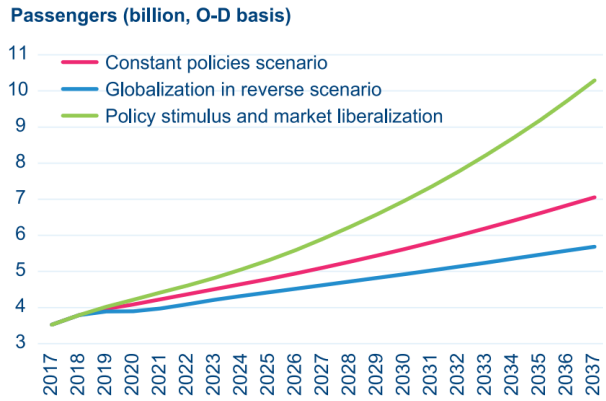


fig. 36-39 Parked Airplane, Passenger Growth Since 1970, Daxing Airport, Projected Growth

The stillness of a parked aeroplane holds all places. Such groundedness suggests only its opposite.

Mark Vanhoenacker[41]

In the modern age, commercial air travel has become a dominant mode of transportation and for the general public it is the most commonly known experience of flight (*fig. 36*). Like older modes of transportation that came before it, air travel has beneficially increased accessibility to distant locations and has shortened the amount of time it takes to travel.

In the United States commercial air travel became an economically viable mode of transportation for many people following President Jimmy Carter's signing of the Airport Deregulation Act of 1978.[42] This diminished federal controls on commercial airlines leading to airline competition, lower fares, and higher passenger volumes. From the 1970s to current day, the number of passengers transported by air has steadily increased (*fig. 37*).

The widespread commercialization of flight has led to the creation larger airplanes in order to move people faster and more efficiently. Consequentially, larger airplanes and more people has caused the spaces that support air travel to become larger—airports. Architecture. The threshold between the earth and the sky. They have become spaces built primarily for efficiency and security. Spaces like the Beijing Daxing International Airport, designed by Zaha Hadid Architects and completed in September 2019, is the largest single terminal airport in the world and is only the most recent example of in a long history of colossally-sized airports (*fig. 38*). As author and architectural critic Alastair Gordon notes, airports have become both "monumental and frighteningly mundane at the same time".[43] With the demand for commercial air travel increasing exponentially, this trend is likely to continue (*fig. 39*).[44]

fig.40-43 Lost Romantic Visions, Mundane, Disconnected, Impersonal

Every airport was once the airport of the future. But time, like our dreams, does not stand still, and we immediately begin our quest for the next great innovation.

Curtis Fentress[45]

Unfortunately, the story of flight has led to a point where the experience of flight has lost its once romantic visions (*fig. 40*). As the dominance of commercial air travel persists and spaces that support commercial air travel like airports have grown larger to alleviate overcrowding from the increasing number of passengers, the human relationship with flight has diminished.

In modern day the experience of flight is commonly viewed as mundane, disconnected, and impersonal (*fig. 41-43*). With the demand for commercial air travel growing many airports have already exceeded or are projected to exceed their capacity. Seattle-Tacoma International Airport in Washington State, for instance, is one of the most trafficked in the United States but also one of the smallest. With the demand for daily flights already surpassing the airport's capacity, the government is actively seeking for other locations to build an additional airport.[46] As the capacity at airports like this struggle to keep up with the demand, the currently dispassionate experience of flying will only compound.

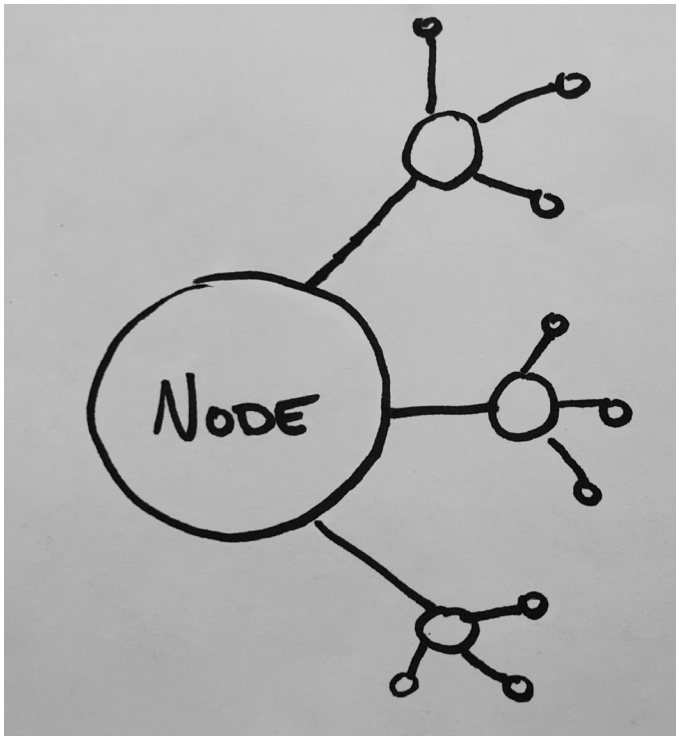


fig. 44 Future Narratives

FUTURE NARRATIVES

The condition of the present allows for imaginations of the future. Where possibilities are vast and the unknowns are seemingly limitless. Potential futures can be examined as continuing narratives of the past, stemming from a certain point in time. These futures are future narratives. Also introduced by Christoph Bode, future narratives are a powerful concept. Rather than events, *future narratives* are defined by nodes which break of into several series of nodes. These nodes hold multiple possible outcomes that emit from a certain point in time (*fig. 44*).

It is important that future narratives avoid simply projecting the events of past narratives into the future. While useful for understanding a historical time-line, Bode argues they are too often applied to projections of the future. By doing this, Bode states, people "miss and deny what distinguishes the future from the past – namely that is has not yet crystallized into one single actuality".[47] The assumption that the future will continue along the same narrative of the past eliminates the compelling openness of the future which has a plurality of narratives. A plurality of futures.

Bode acknowledges the presence of events in both past and future narratives, but believes that nodes, distinct to future narratives, are different than events. A node is a "point in time that allows for more than just one continuation and that, once any one of these continuations has been realized, transforms potentiality into actuality".[48] While someday a node may become an actual event, it is important to preserve the uncertainty that multiple futures hold in order to promote and embrace the possibilities they can bring. This avoids the projection of past narratives into the future and allows for new potentials to be imagined.

fig. 45 The Futures of Flight

Passed years seem safe ones, vanquished ones, while the future lives in a cloud, formidable from a distance.

Beryl Markham[49]

The present time in the story of flight can be thought of as a node where many futures exist—the futures of flight. The node is now. The resulting nodes can only be based on imagination. They cannot be known but they can be envisioned. It is possible to imagine these futures hold several possible outcomes and the human relationship with flight will continue to change.

The common understanding of flight and experience of the sky could follow many narratives (*fig. 45*). Among many others, it could actualize popular visions of the future such as *Blade Runner* or *The Jetsons.* It could follow speculations of the unconventional such as Georgii Krutikov or Frank Lloyd Wright. It could continue on its current trajectory with commercial air travel becoming increasingly large-scale and mundane. Or it could follow a different narrative. A narrative that presents an opportunity to enhance the human relationship with flight.

The node is now. The narratives have yet to be written. The futures have yet to be realized and so have their possibilities. One of the possibilities worth exploring is the emergence of Vertical Takeoff and Landing vehicles which hold the potential to change the human relationship with the sky, the earth, and flight.

fig. 46 Vertical Takeoff and Landing Prototype

VERTICAL TAKEOFF AND LANDING

Vertical Takeoff and Landing (VTOL) is an emerging aircraft typology. Dozens of companies around the world are currently investing time and money in VTOL as a viable means of air transportation for the coming future.

Many different prototypes, uniquely designed but similar in scale, are currently in the development process. They combine the benefits of multicopter aircraft and fixed wing aircraft (*fig. 46*). As the name Vertical Takeoff and Landing implies, VTOL vehicles are capable of vertical hover for takeoff and landing but can also fly horizontally at high speeds.[50] Some operate with a pilot while others operate autonomously. Similar to helicopters in size and seating capacity, they offer a close and personal relationship with the aircraft and the experience of flying (*fig. 47*). Unlike helicopters many models are hybrid or fully electric and are significantly quieter. Unlike typical airplanes which need an airstrip for lift, VTOL needs minimal space to achieve lift resulting in less required space on the ground. As an alternative means of air travel they have the potential to be less intrusive on both the built and natural environments.

fig. 47-50 Close Relationship, Rideshare, No Existing Infrastructure, Urban Design Proposals

Mark my words, a combination airplane and motorcar is coming.
You may smile, but it will come.

Henry Ford

One of the most compelling aspects of Vertical Takeoff and Landing Vehicles is their projected use as rideshare or air taxi vehicles within the coming decades.[51] This allows passengers to order flights through phone applications at relatively affordable costs (*fig. 48*). Companies like Uber have even projected these air taxis to become available in select cities starting in 2020.[52]

Currently, however, there is no existing infrastructure or landing spaces to support VTOL vehicles (*fig. 49*). This presents the opportunity to develop new design proposals. Some current proposals do exist, but they have primarily focused on urban areas as places where they might be used most frequently (*fig. 50*). These proposals fail to look beyond the urban environment to other areas where VTOL could be used. The extra-urban. Places beyond the obvious. Places where flight can begin to exist.

fig. 51 Beyond Urban

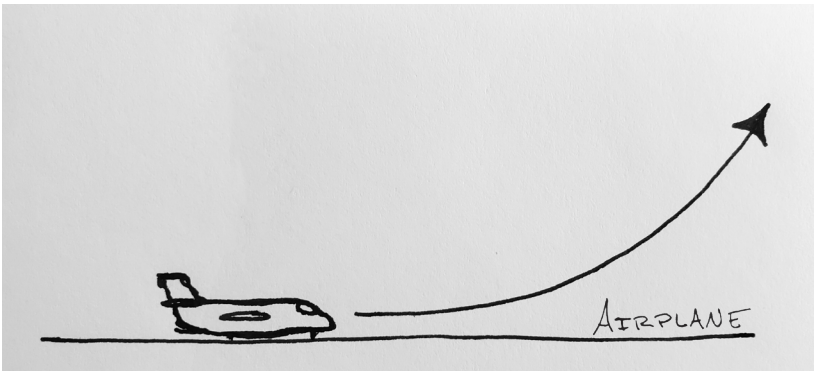
4

THE FUTURES OF FLIGHT

On the earth already means under the sky. Both of these also mean remaining before the divinities and include a belonging to men's being with one another. By a primal oneness the four—earth and sky, divinities and mortals—belong together in one.

Martin Heidegger[53]

Possibilities of flight and imagination are continually expanding. The futures of their stories have yet to be written. They are unknown. The relationship between humans, the earth, and the sky is bound to change. Both realms are filled with vast potential for new experiences and potential futures existing at a threshold between them. This is where architecture plays its role. It is the space where new relationships and new possibilities can be found. Vertical Takeoff and Landing vehicles present an opportunity to establish a new relationship with flight. One in which the earth and the sky have more direct access to one another—a vertical connection.



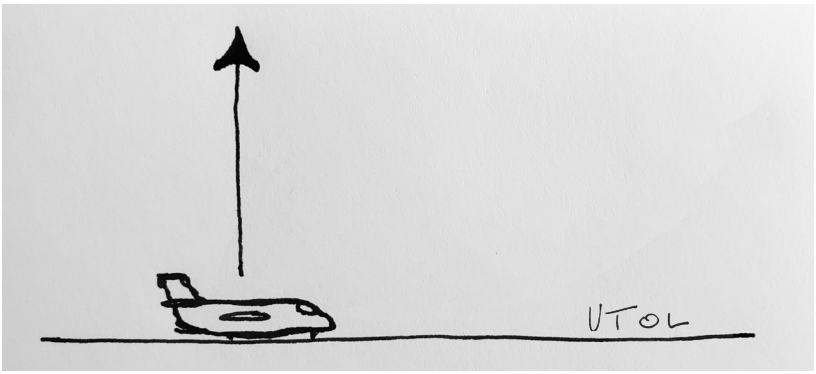


fig. 52 Airplane vs. VTOL Movement

P R O P O S A L

The thresholds between the earth and the sky are where the futures of flight can find there strongest connections. The emergence of Vertical Takeoff and Landing vehicles presents the opportunity to explore the implementation of new thresholds—new infrastructure. This thesis proposes an infrastructural system consisting of VTOL supporting spaces called ‘skyports’. Skyports, unlike conventional airports, operate at a much smaller scale and are specifically designed to accommodate VTOL vehicles. Additionally, while a typical airplane uses a runway for gradual lift, the vertical movement of VTOL presents the opportunity to express a direct connection between the earth and the sky (*fig. 52*).

Skyport designs can be implemented in urban areas and beyond (*fig. 51*). The majority of commercial airports and currently proposed skyport designs are located in or around large metropolitan areas. These areas become centrally located air travel hubs that serve entire regions. A system of skyports can instead decentralize the infrastructure of flight and bring local access to air travel across large regions. They can be placed in urban areas, suburban areas, rural areas, and even beyond to remote areas. The small scale of VTOL vehicles and amount of required landing space allows these skyports to also be small in scale. Feasibly, a large number of skyports can be implemented in various locations throughout certain regions with minimal impacts on the built and natural environments.

fig. 53-59 Coasts, Forests, Cities, Plains, Rivers, Mountains, Rhythm of Earth and Sky

WASHINGTON STATE

The state of Washington is one example that serves as a viable location to implement a regional system of skyports (*fig. 60*). Washington is well-established within the existing story of flight, in particular companies like Boeing have fostered a tradition of innovation and forward-thinking in the airline industry. This tradition can serve as a groundwork with the potential to expand even further.

Washington is also notable because of its unique environments where the earth and the sky meet in vastly different ways. The western half of the state is particularly interesting because of the drastic differences in human environments, topography, terrain, climates, habitats, and natural features. Among others, the major environments include dramatic coastlines, dense forests, towering and crouched cities, depressed plains, carving rivers, and formidably rugged mountain ranges (*fig. 53-58*). Together they form a rhythm where at points the ground reaches up and others the sky reaches down (*fig. 59*).

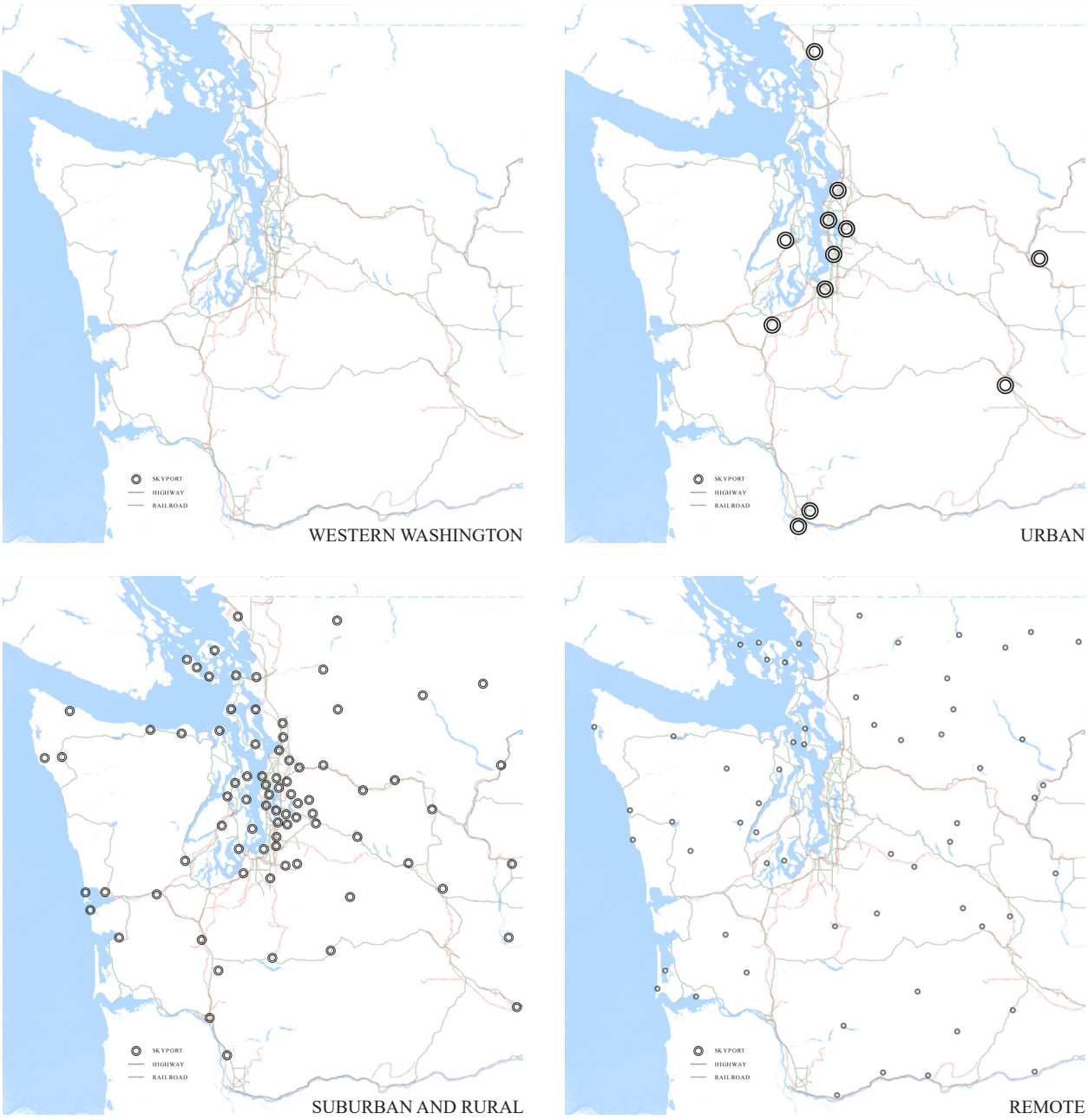


fig. 60-63 Map of Western Washington, Urban Skyports, Suburban and Rural, Remote

REGIONAL SKYPORT SYSTEM

Washington's unique environments are strategically combined with various cities and remote locations to inform where skyports can be implemented. Human environments are chosen for variations in scale, population, density, proximity to metropolitan areas, and proximity to existing ground infrastructure such as highways and railroads. Implemented skyports are placed in urban, suburban, rural, and remote areas of the state (*fig. 61-63*) within the six formerly identified environments.

Each skyport should reflect their chosen locations by responding to natural and built features, number of potential users, city scale, and site-specific context. Particular consideration should be made for the types users and forseeable uses of VTOL air travel. Uses include commuting, recreation, business, travel, and potentially others.

All these locations have the potential to expand even further. Locally, regionally, domestically, internationally. Places where flight can take people to virtually every environment, physically connecting places through the sky that are currently only connected on the ground. Places beyond the obvious where flight can begin to be imagined. Where its futures may go.

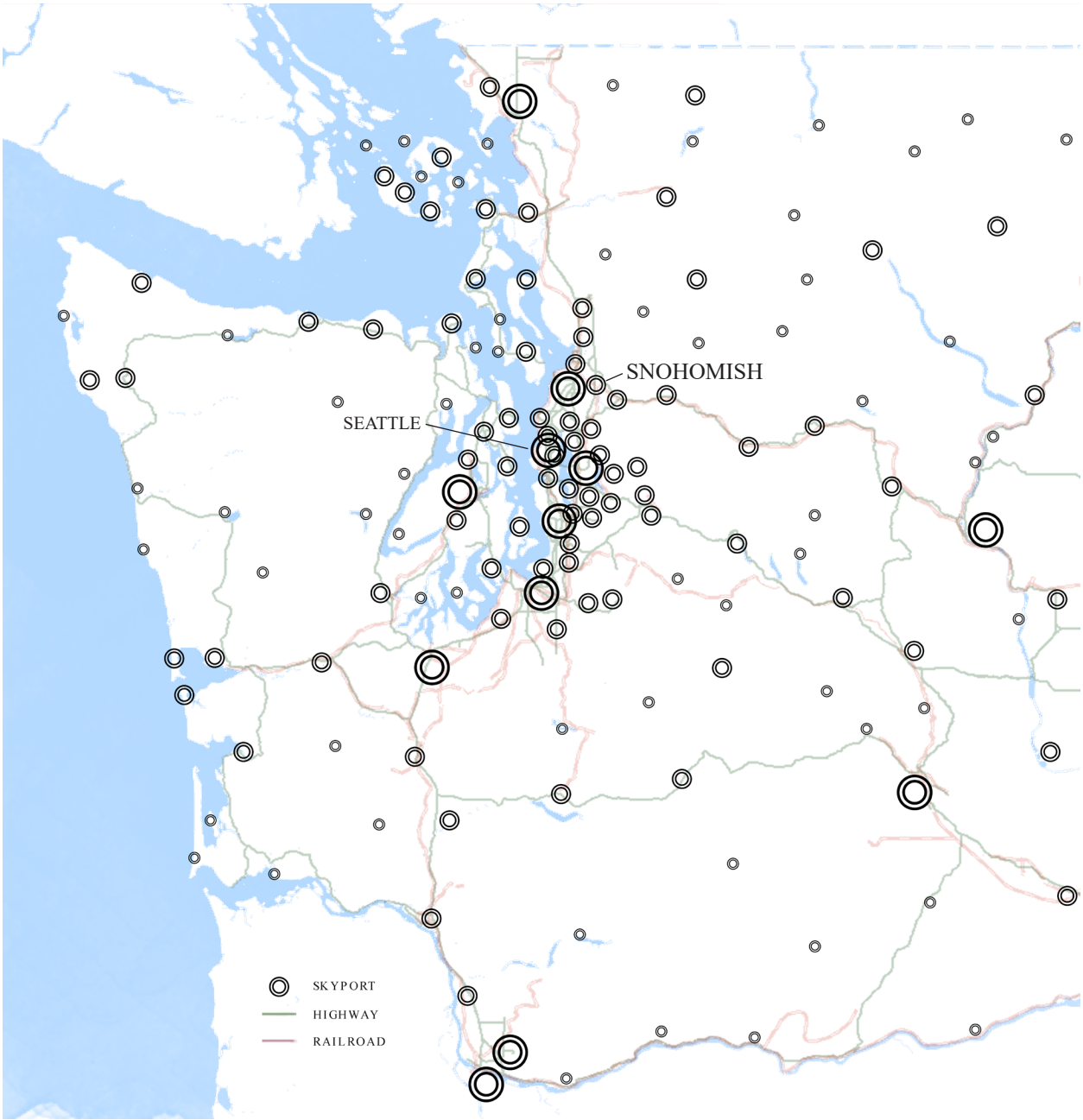


fig. 64 Proposed Skyports in Western Washington

S N O H O M I S H

One possible location to implement a skyport in western Washington is the town of Snohomish. Located 30 miles from Seattle, the major metropolitan city in the region, Snohomish has a population of approximately 10,000 people (*fig. 64*). The town is in a relatively flat agricultural basin visibly surrounded by forests and mountains. Running through the basin is the Snohomish River fed from the Cascade Mountain Range to the east, flowing towards Puget Sound to the west with downtown Snohomish nestled on a small stretch of land along the northern bank of the river (*fig. 65*).

Several factors inform the selection of Snohomish as a proposed skyport location. The river winding through the flat agricultural land presents an interesting natural feature where the earth is carved away and a local climate is created. On many mornings a thick fog will form over the river while on clear days it reflects the open blue sky. There are also two distinct patterns of human movement with a heavily-trafficked highway running through the center along with pedestrian-friendly downtown streets. There are moments where the rigidity of existing industry and the remnants of past industry converge with the fluid river. There are older modes of transportation with operational and abandoned railroad tracks along the south side of the river. Also on the south side of the river is Harvey Airfield, a regional airport primarily used for recreational aircraft. Combined these forces act as one converging at a site filled with potential (*fig. 66-68*).

fig. 65 Aerial View of Snohomish

fig. 66 River and Industry Converge

fig. 67 Infrastructures Converge

fig. 68 Built and Natural Environments Converge

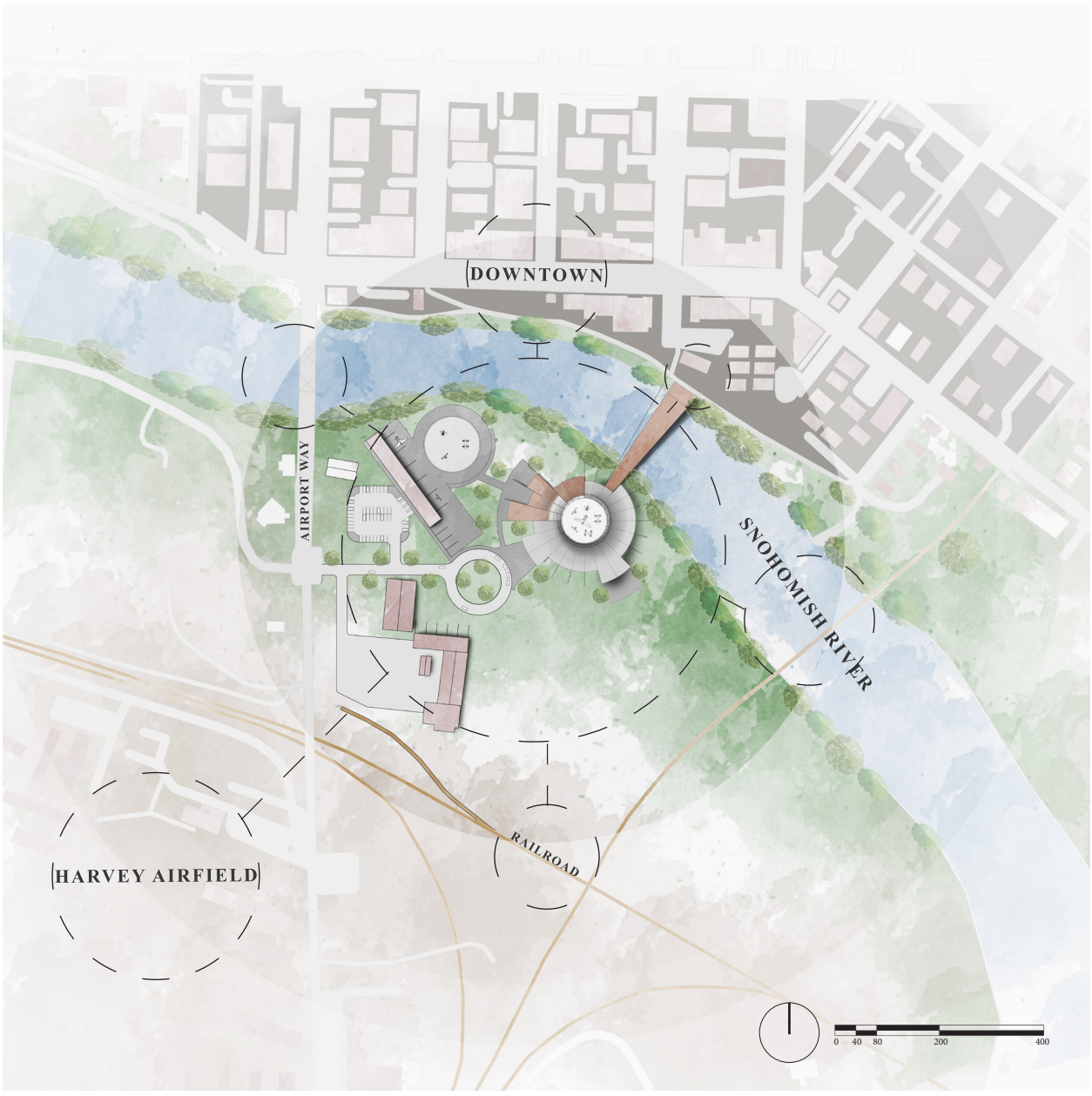


fig. 69 Vicinity Plan

THE SITE

The convergence of forces in Snohomish inform the chosen site similar to the dualities that inform imagination (*fig. 69*). Representing what is new and old, fast and slow, lively and solemn, natural and unnatural. At the center of these dualities sits the site, acting as a threshold not only to the sky but also to the earth. Both vertically and horizontally. It seeks to embody imaginations of the past, present, and futures.

The site is located at the former Snohomish Lumber Mill which closed down in 2015. In the summer of 2019 several buildings on the site along the bank of the river were mostly destroyed in a fire, sitting in disrepair ever since. Rising from the bones and the ashes is a design proposal for the Snohomish Skyport.

By understanding the existing forces on the site, the design looks to form new relationships with the river, the downtown, pedestrians, cars, the railroad, old industry, and new industry.

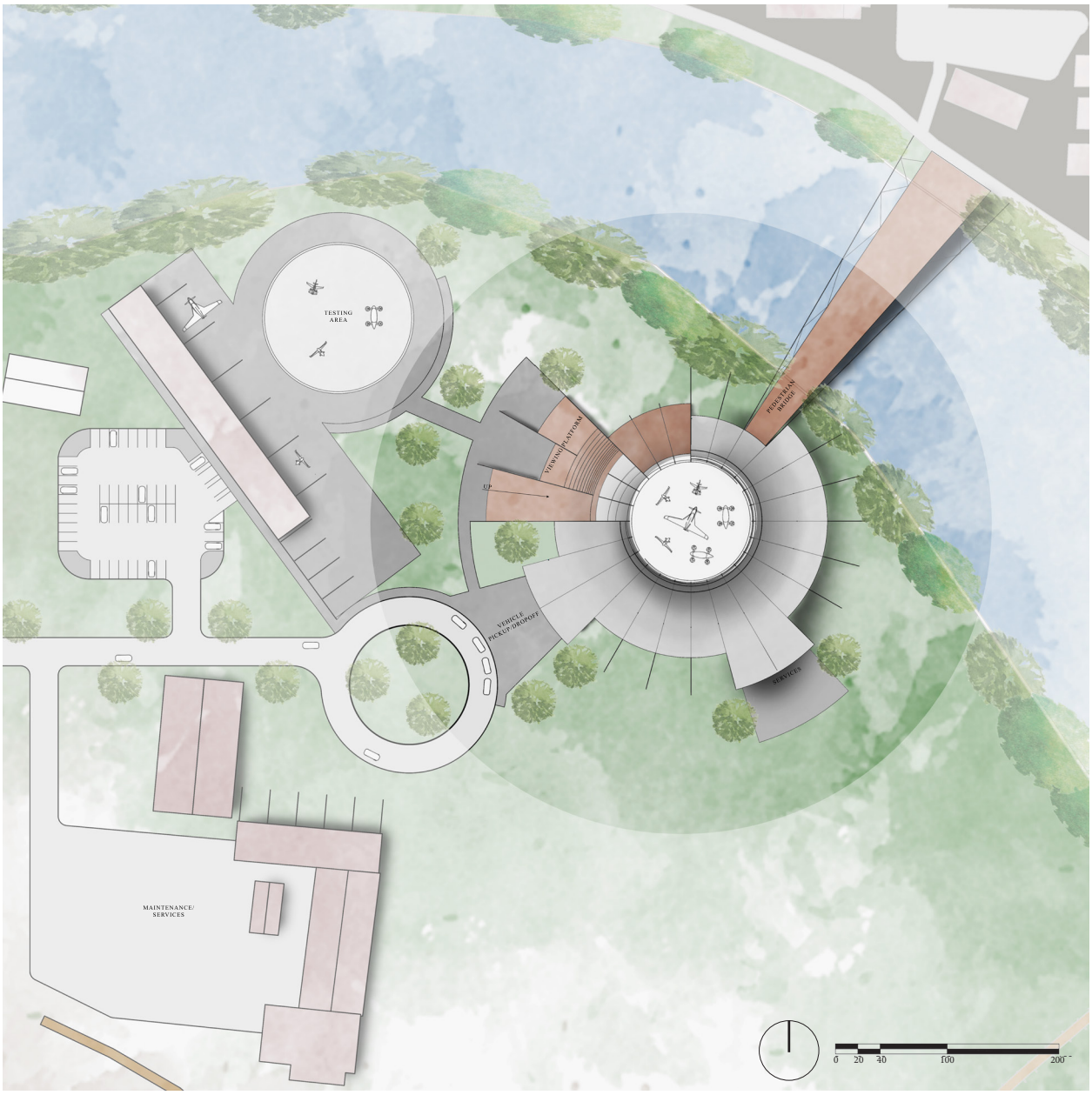


fig. 70 Site Plan

SKYPORT DESIGN

There are three primary goals this design looks to achieve. First, to foster a positive and personal relationship with flight. A new relationship with flight. Second, to use architecture in a way that connects the earth and the sky and forms a direct transition between the two. A threshold. Third, to develop strong ties to unique natural and built environments. Places where flight currently cannot go but can be imagined to go. Future possibilities.

Several of the identified relationships inform the layout of the site (*fig. 70*). Breaking off the skyport on the northeast side is a new pedestrian bridge that connects to an existing riverfront walkway on the downtown side. The west side of the site brings in car traffic from the main highway, conveniently named Airport Way. On the southwest side existing structures from the old lumber mill are repurposed as maintenance and service buildings. Adjacent to an operational railroad line, VTOL aircrafts and parts can be shipped and delivered here. The northwest side uses structure still intact from the burned down portion of the lumber mill to create a testing space for VTOL prototypes. From downtown the site is meant to be visually engaging without disrupting the patterns of existing life. Physical access is encouraged and the site is intended to be open to the public for those boarding flights or others curiously enjoying the spectacle of flight.

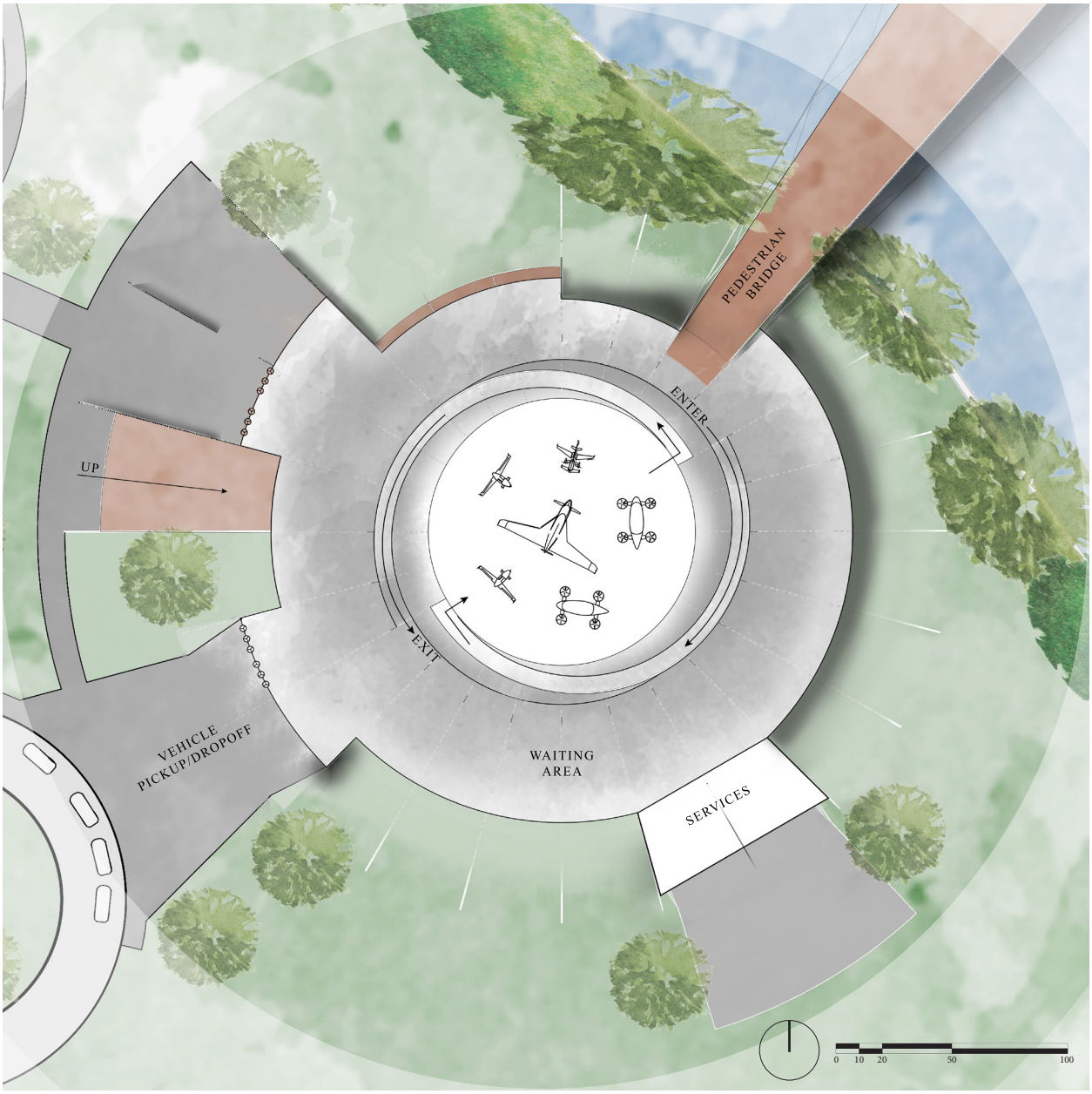


fig. 71 Floor Plan

The skyport itself is slightly setback from the edge of the river forming a respectful but direct relationship between the two (*fig. 71*). Access into and out of the space for those coming and going on foot is provided by the pedestrian bridge extending from the northeast end of the skyport across the river. A separate entrance for those arriving or departing by car emanates from the southwest side with vehicle pickup and dropoff zone. Circulation into the below-grade VTOL landing area spirals down from ground level for those boarding and spirals up for those departing. On ground level circling the landing area below is space for passengers waiting for flights. A service area on the southeast side is available for restrooms and back of house operations. Next to the testing area on the northwest edge is a wide ramp leading from ground level on the exterior side to a public viewing deck hovering above a portion of the waiting area. From here people can watch as VTOL aircraft come and go. Highly visible and highly active.

The design looks to express the movement from earth to sky vertically by employing two major movements to form a space that both reaches up and peels down (*fig. 72*). Rough, durable materials such as wood, reinforcing the earth, slope up to form the viewing platform then fall down into the landing area creating covered space below. The below-grade landing area provides a deeper connection to the earth and responds to carving condition of the river. Even deeper below the landing area is a space where aircrafts can be lowered for services and charging while newly arriving aircrafts come in to land. Light, airy materials such as fabric, reinforcing the sky, reach up forming a roof for the skyport and an opening for flight. Together these movements form a design acting as a threshold between the earth and the sky.

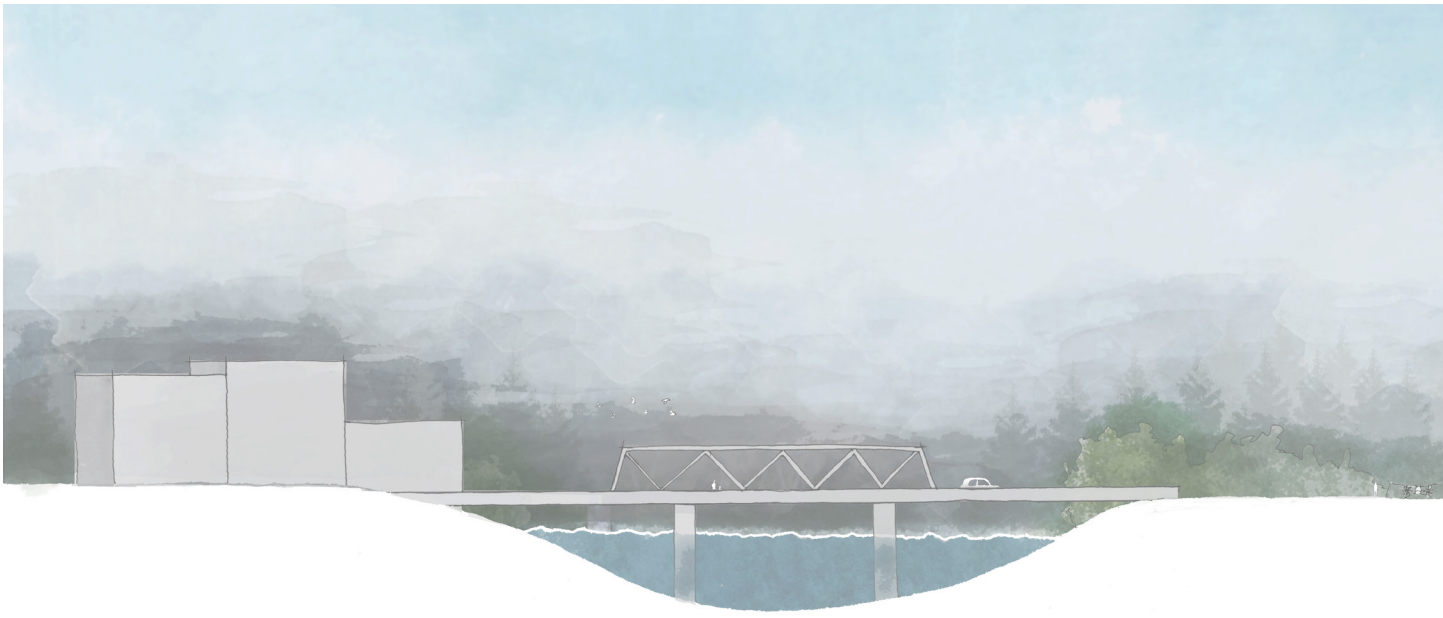
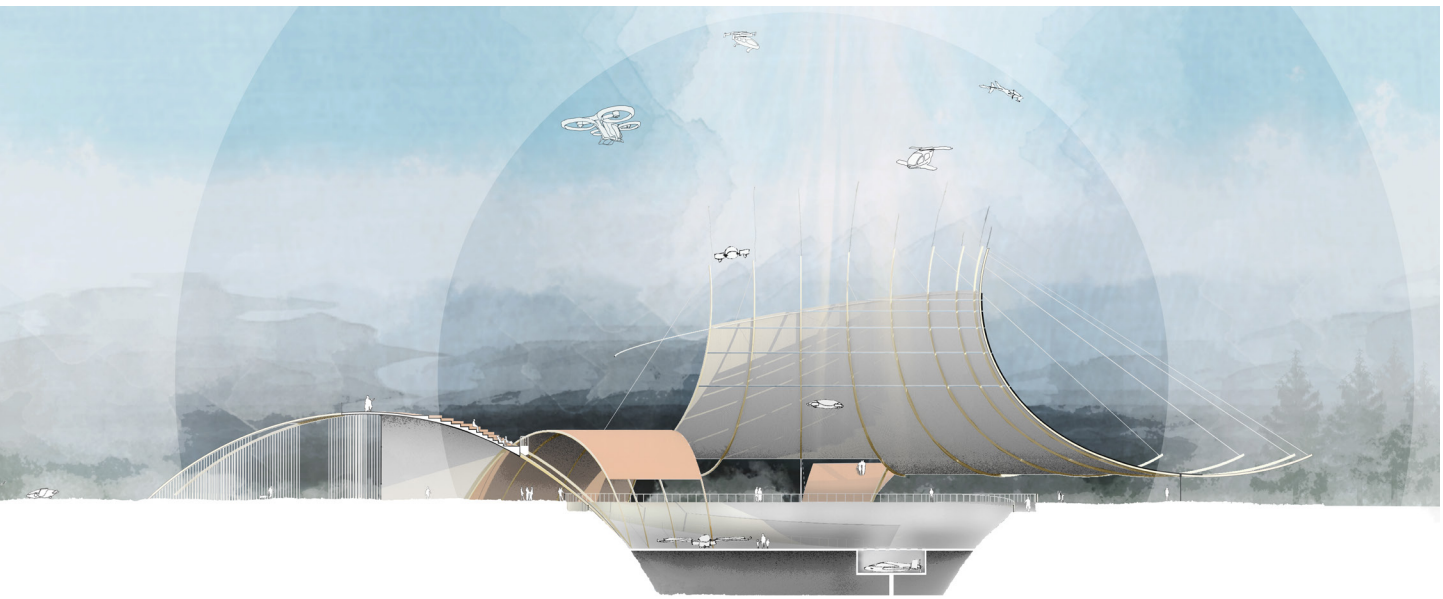


fig. 72 Section



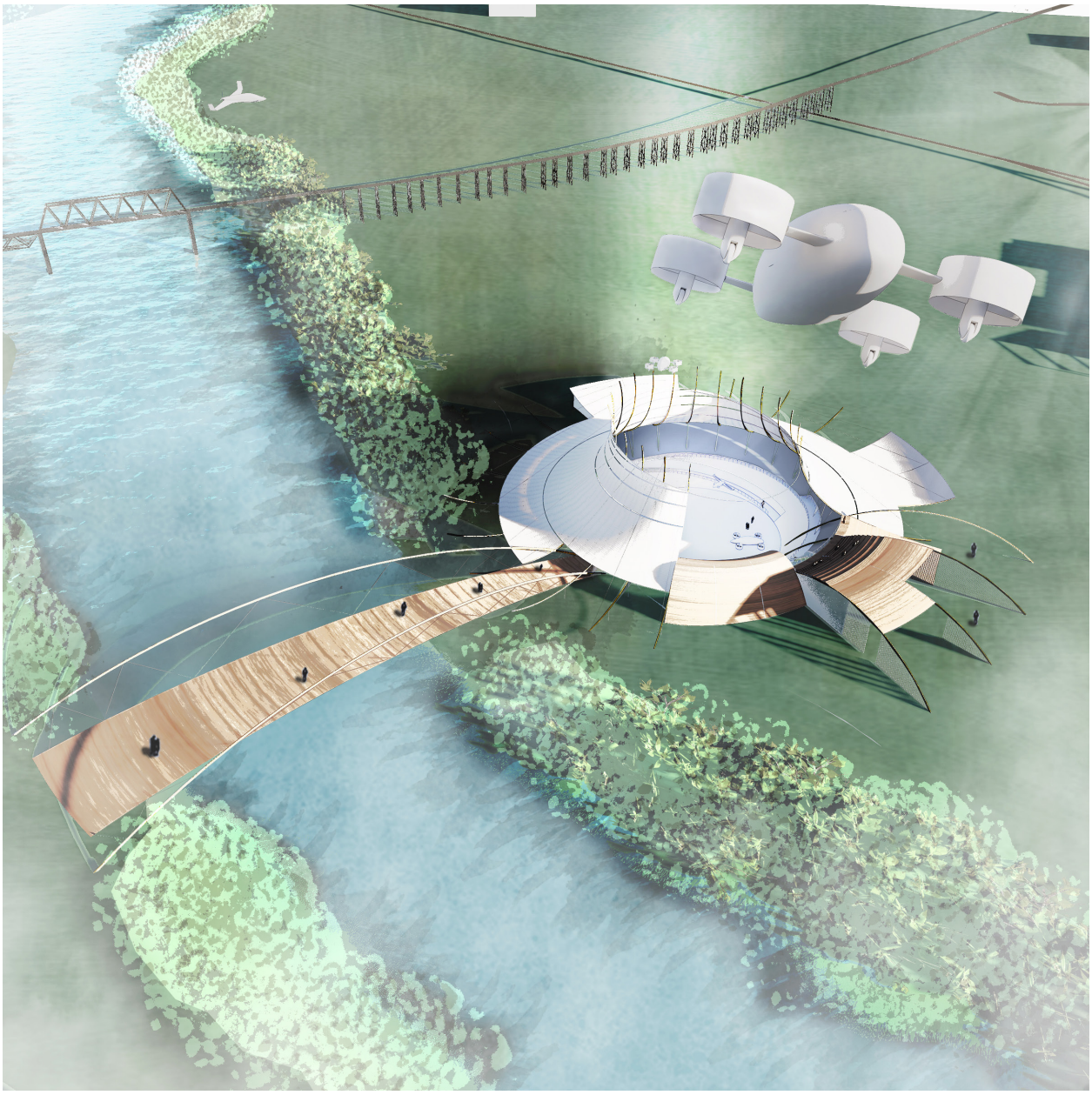


fig. 73 Perspective from Above

The proposed design set out with three primary goals. To establish a new relationship with flight, to form a threshold between the earth and the sky, and to allow for further possibilities. These goals were approached by first, developing a space that encourages close proximity to flight, both the act and the spectacle. Second, by vertically expressing the earth peeling up and the sky reaching down. Third, by responding to a unique environment where flight can exist and inspire further imaginations.

While the design is a threshold it is also reminiscent of a node breaking off into several possibilities. Connecting events of the past but also leading to multiple futures. It is important to remember that this is only one possible location and one potential future. Hopefully this future has the potential to expand the understanding of what is possible and what can be imagined, so the futures of flight can continue to be realized.

fig. 74 Perspective from Below

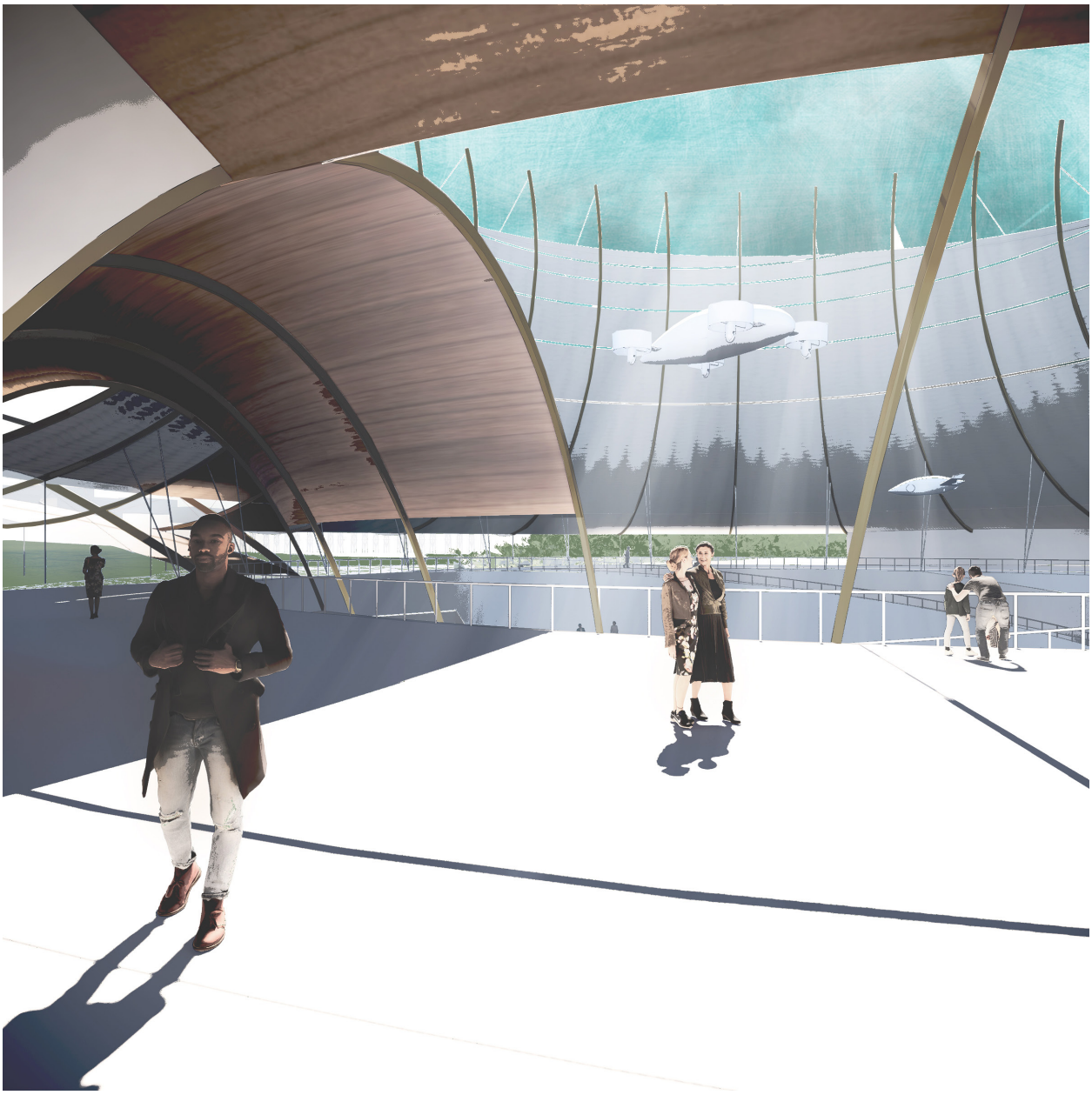


fig. 75 Perspective from Ground Level

fig. 76 Final Presentation

5

CONCLUSION

We see clearly that all the images of the visible things, both large and small which serve us as objects, enter to the sense through the tiny pupil of the eye...through so small an entrance there passes the image of the immensity of the sky and of the earth.

Leonardo da Vinci[54]

Flight is possible because it was imagined. With time, resistance of perceived impossibilities led to new possibilities and new perceptions. This cycle continues into the present and will continue into a multitude of potential futures. That is why imagination is so powerful. It discovers capability.

The futures of flight cannot be known but they can be envisioned. The world will change, technology will change, interests will change, values will change. Unknown changes should be preserved because they will lead to future imaginations that cannot yet be conceived of. Realms of understanding will continue to be traversed. What is productive will become reproductive, what is fiction will become reality, and what exists mentally will exist physically. Time and space facilitates the fluidity of imagination. This does not hinder imagination, it enables it to expand and to change. Perpetuating even further possibilities.

fig. 77 Process Board

The emergence of Vertical Takeoff and Landing acts as one opportunity to find new potential futures. By promoting unknown changes the proposed regional system of skyports allows for futures to spread, reaching destinations untouched by flight. They are thresholds where the earth and the sky are fluidly composed. They are nodes where new futures may lie. Ideally they can enhance the human experience of flight and inspire the next generation of imaginations. Where the former dreams of those like Leonardo da Vinci are met and surpassed.

The human relationships with the earth and the sky are filled with vast potential. These relationships have developed throughout the story of flight—the story of imagination, enduring through the eyes of those who have and those who will envision futures to come. New resistance will be found and the futures of flight will continue to be discovered, expanding beyond what is currently conceivable.

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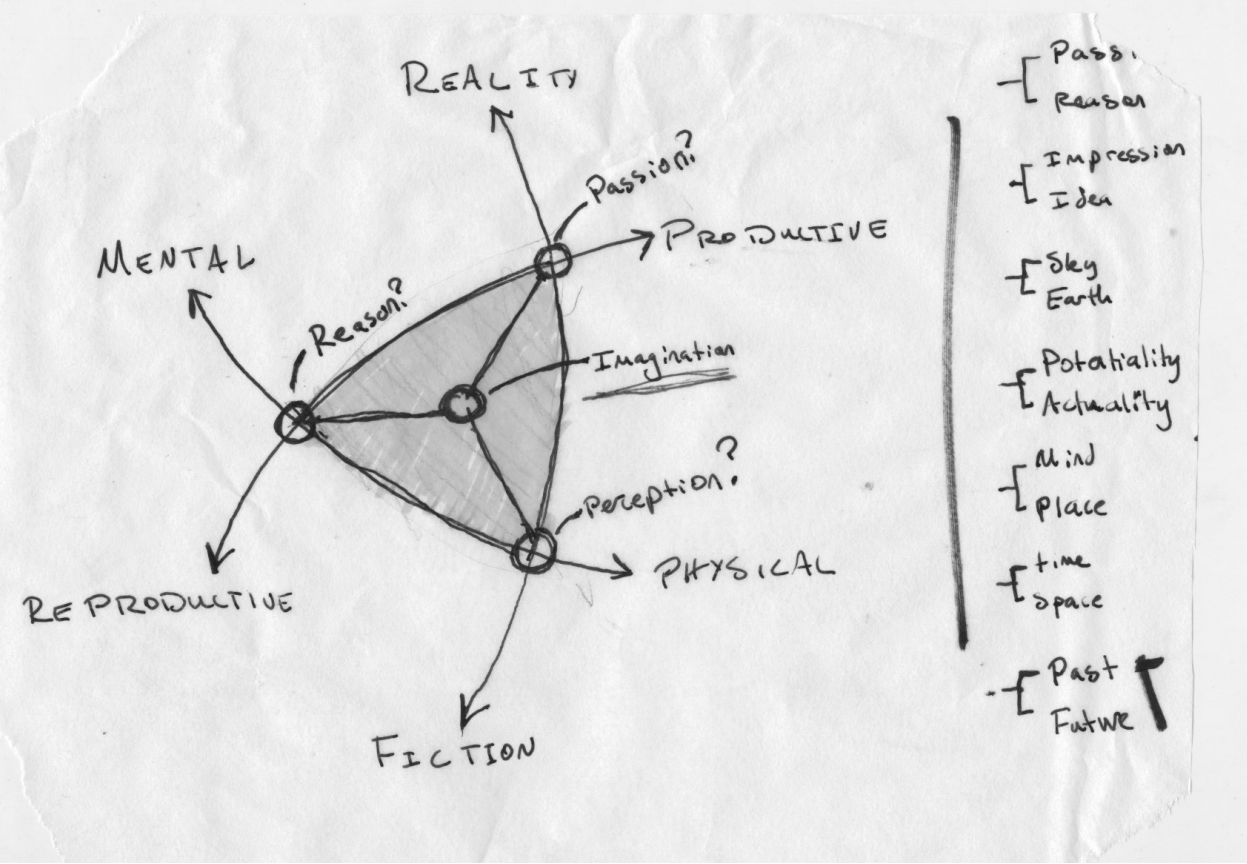
LIST OF FIGURES

All images are created by author unless otherwise noted

APPENDIX



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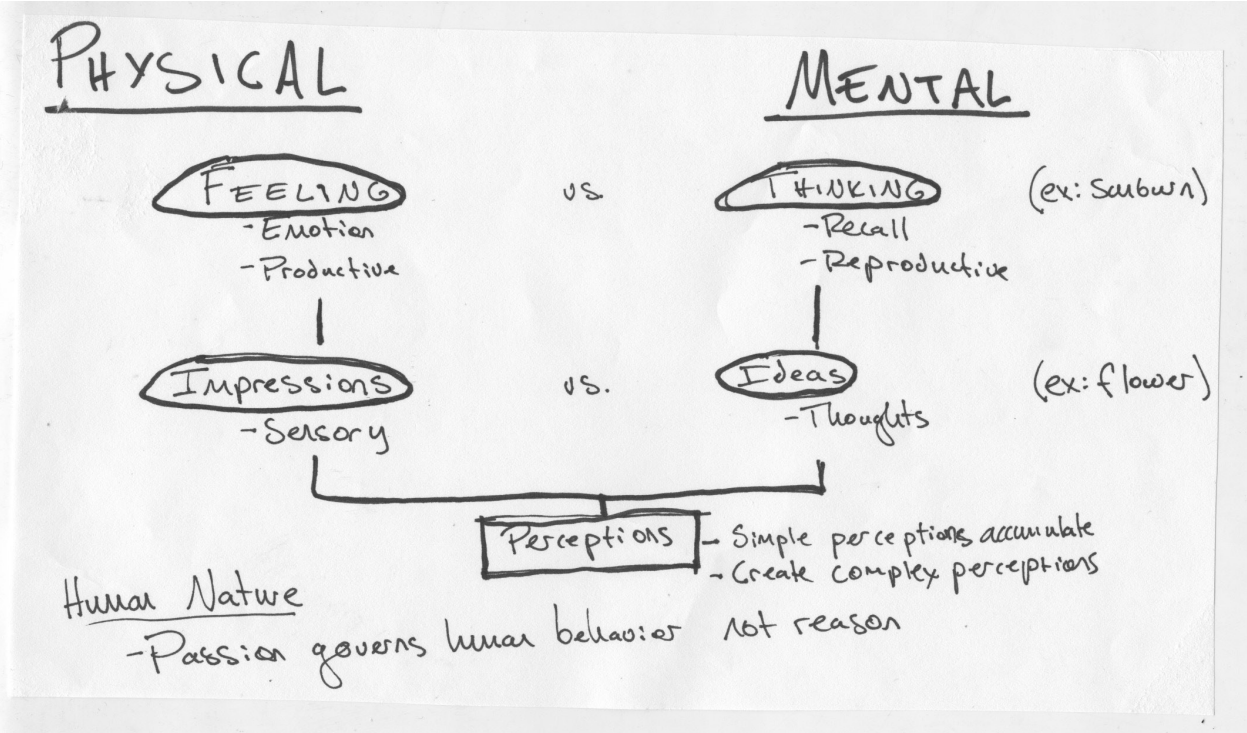

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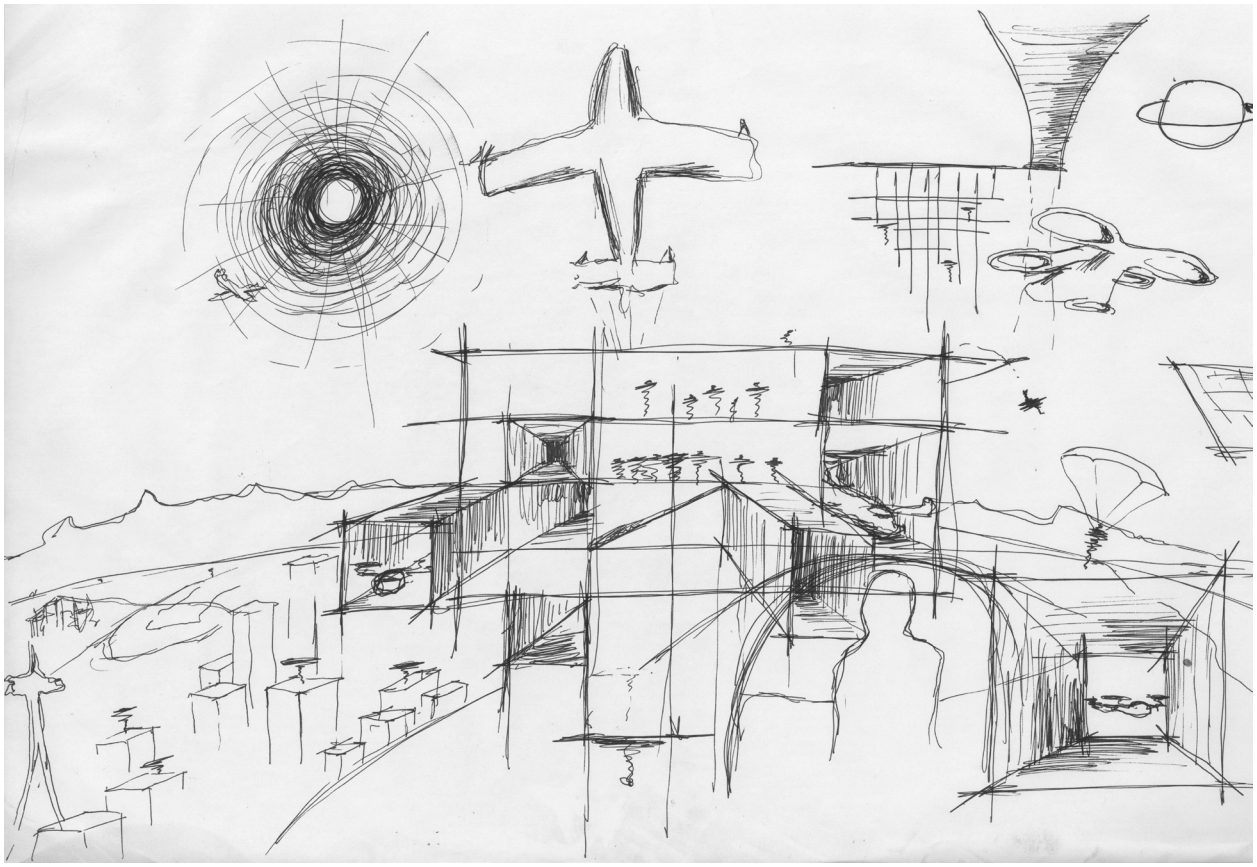

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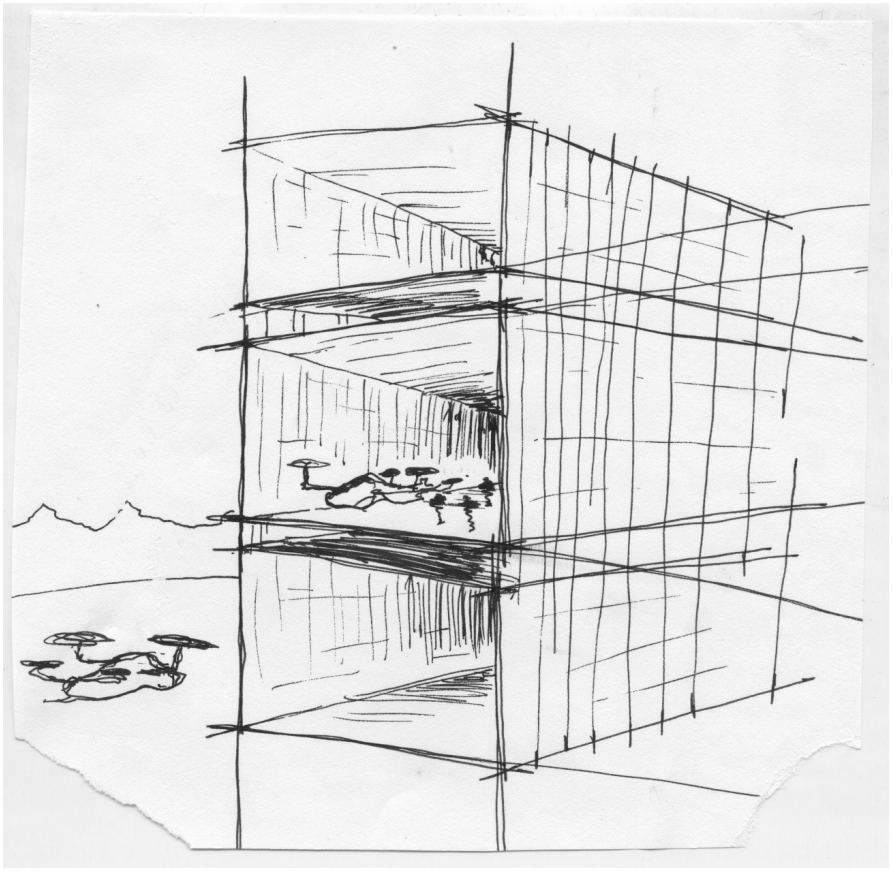

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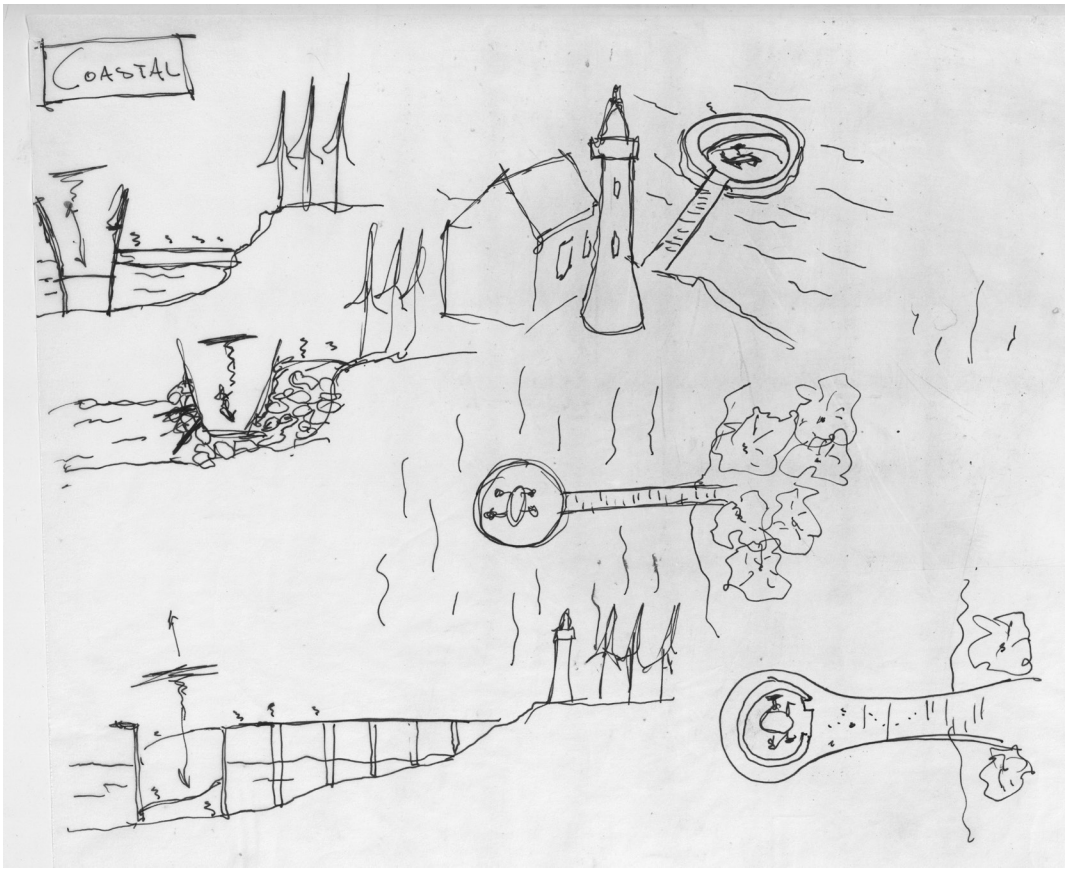

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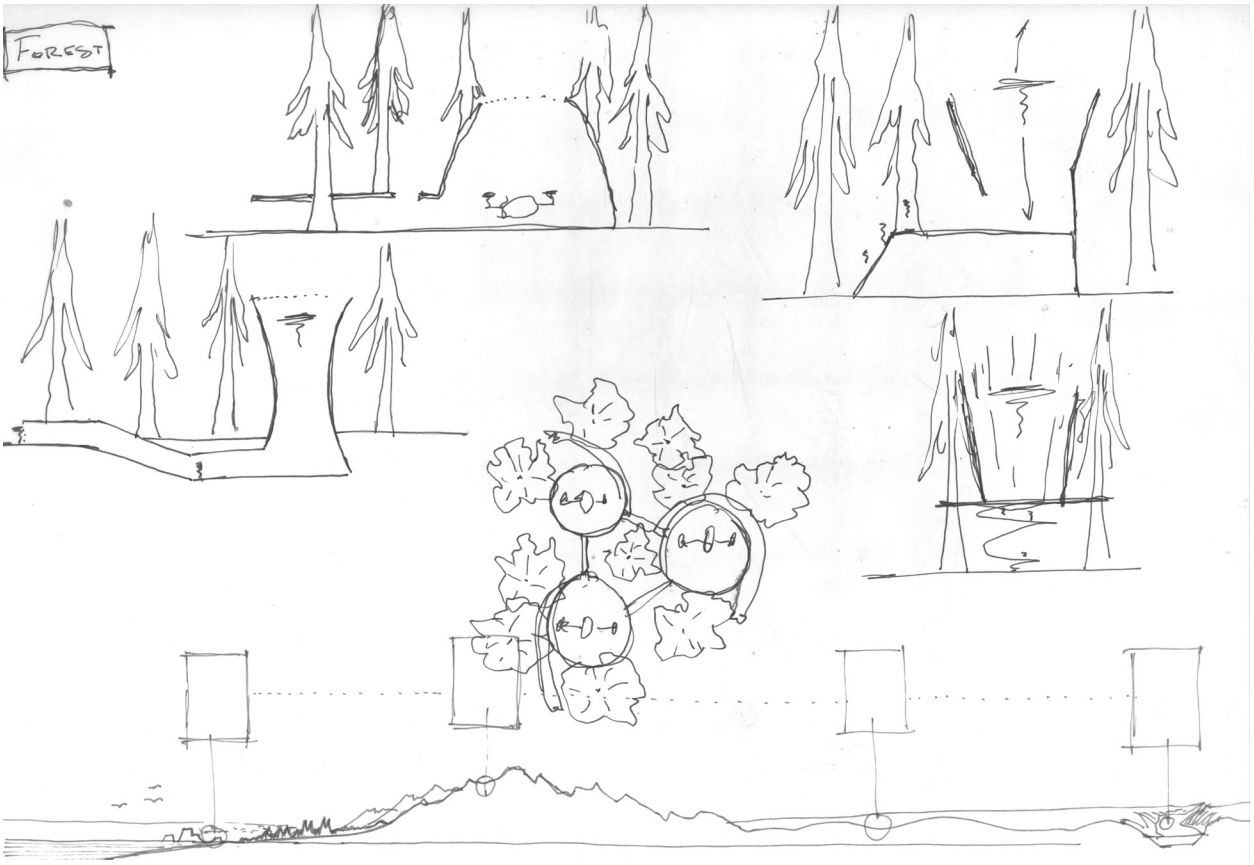

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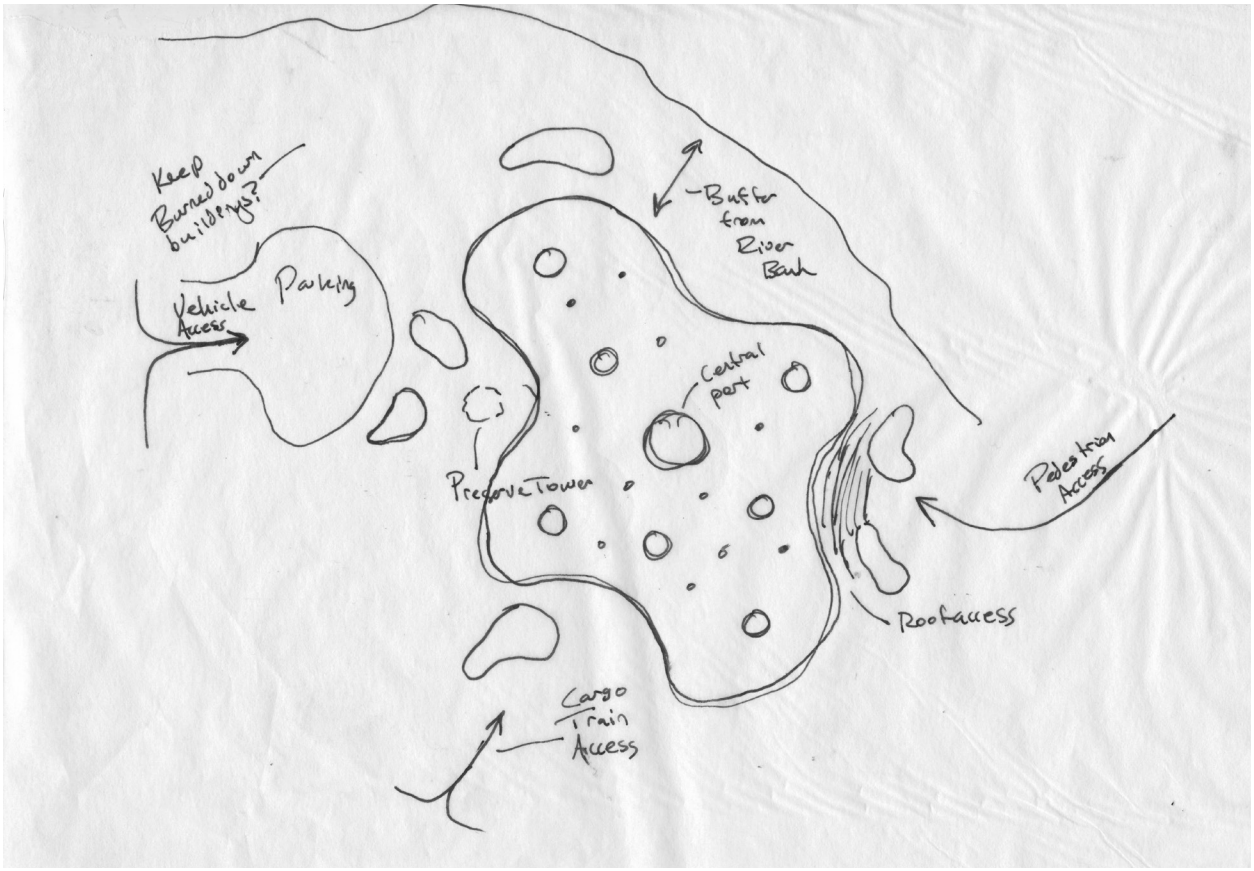

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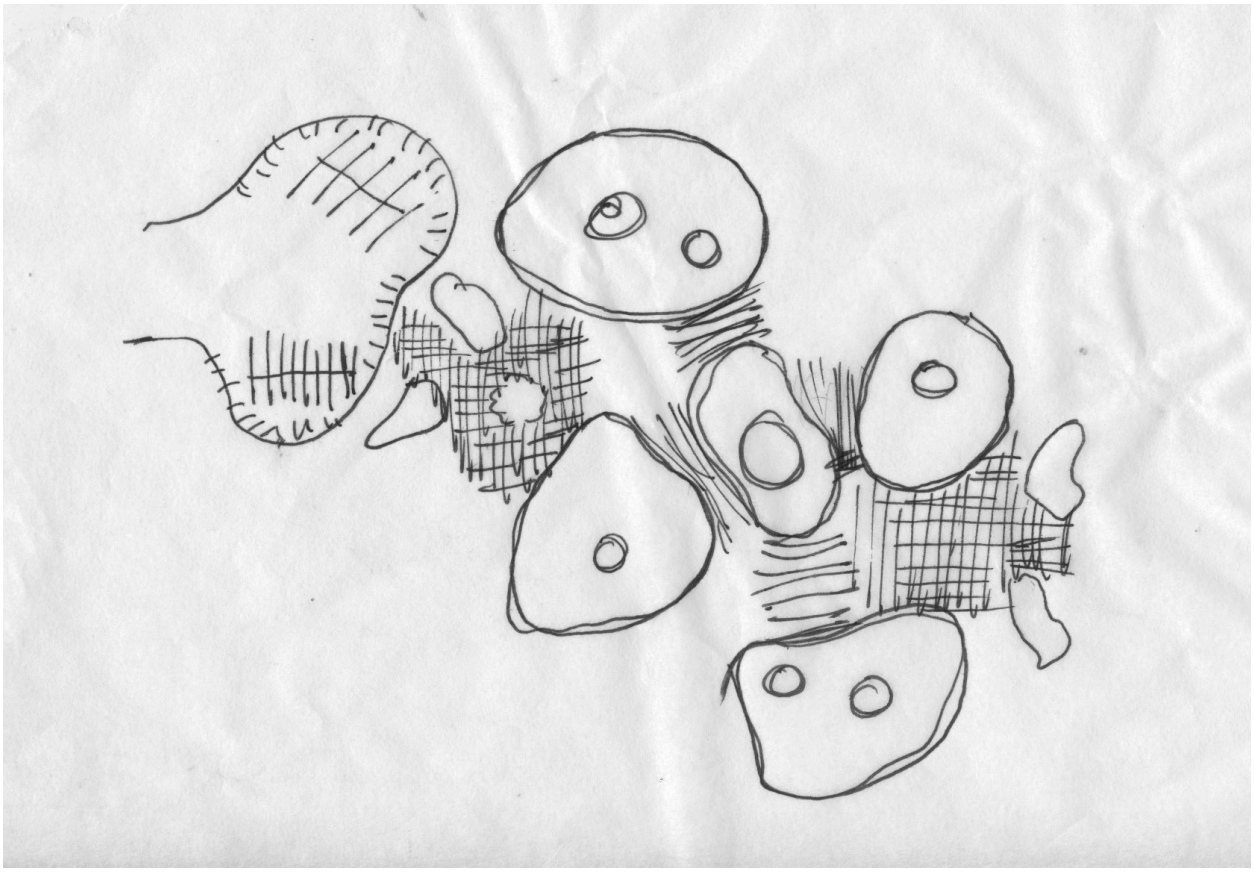

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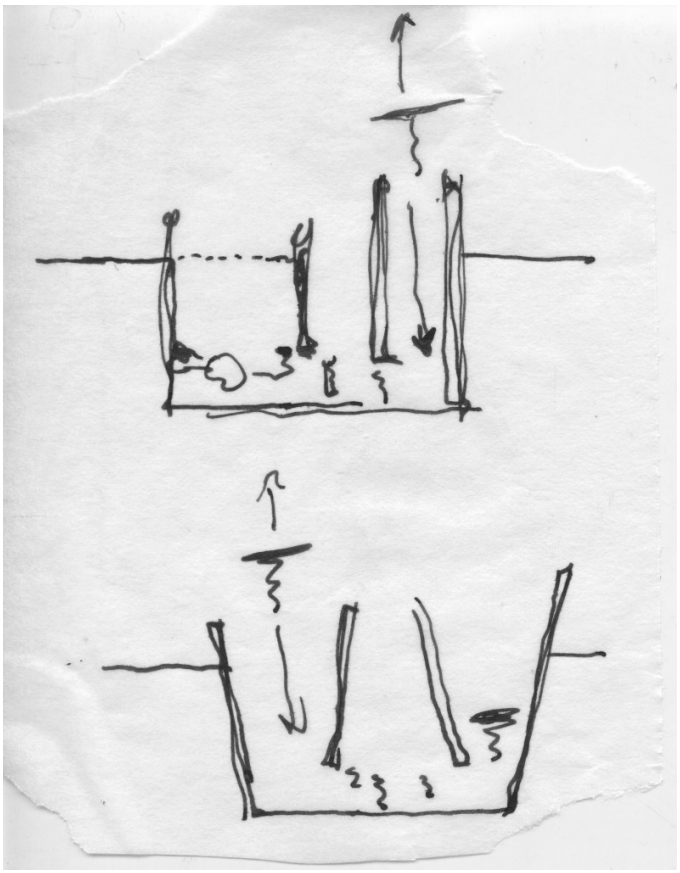

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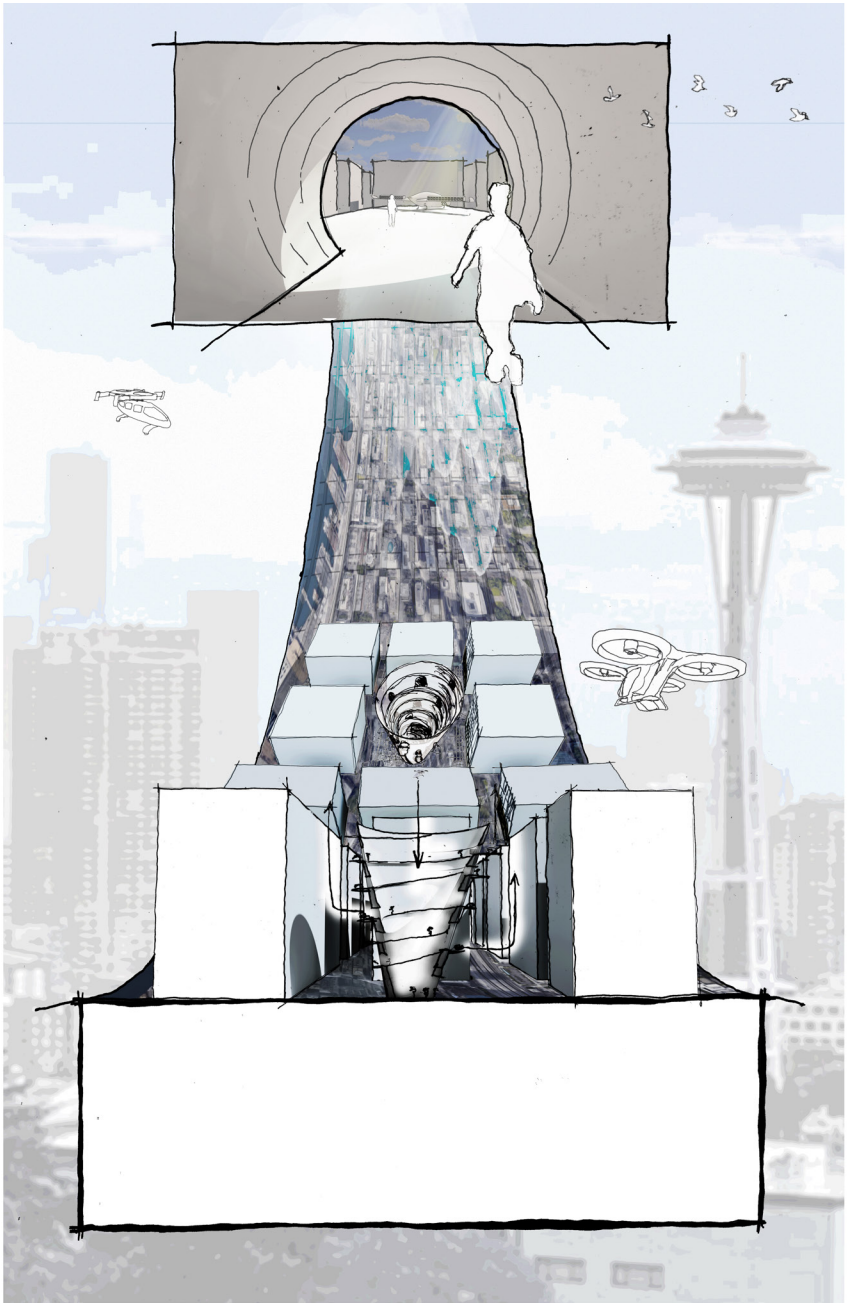

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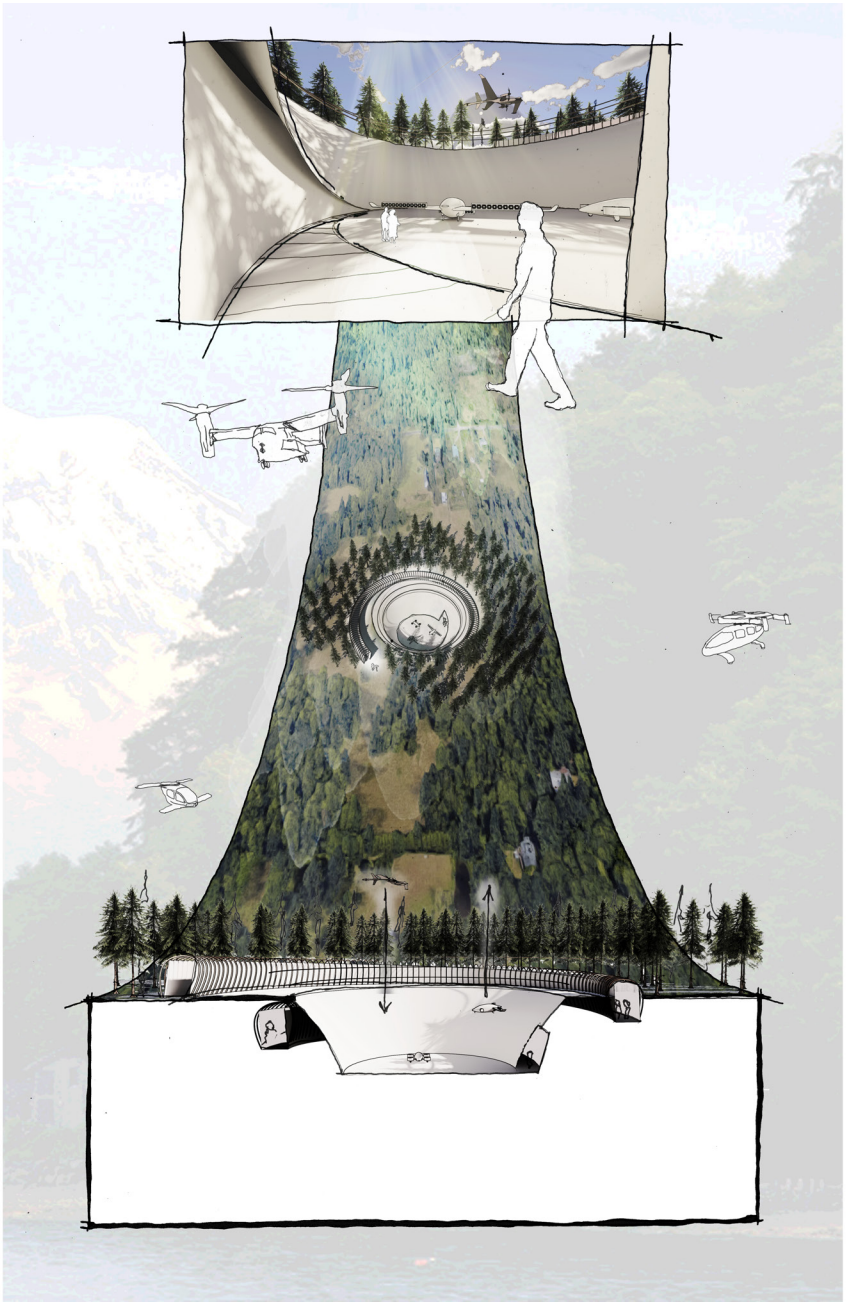

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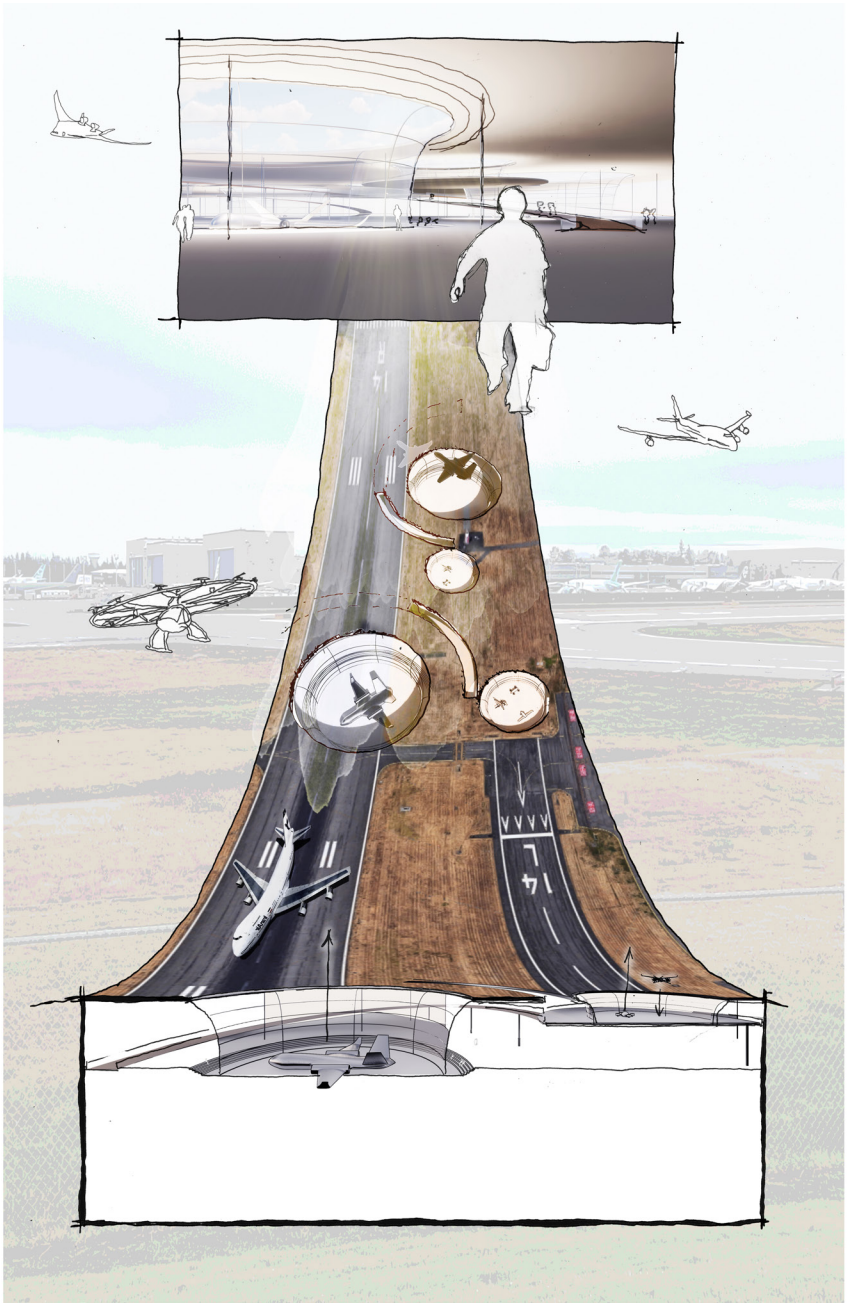

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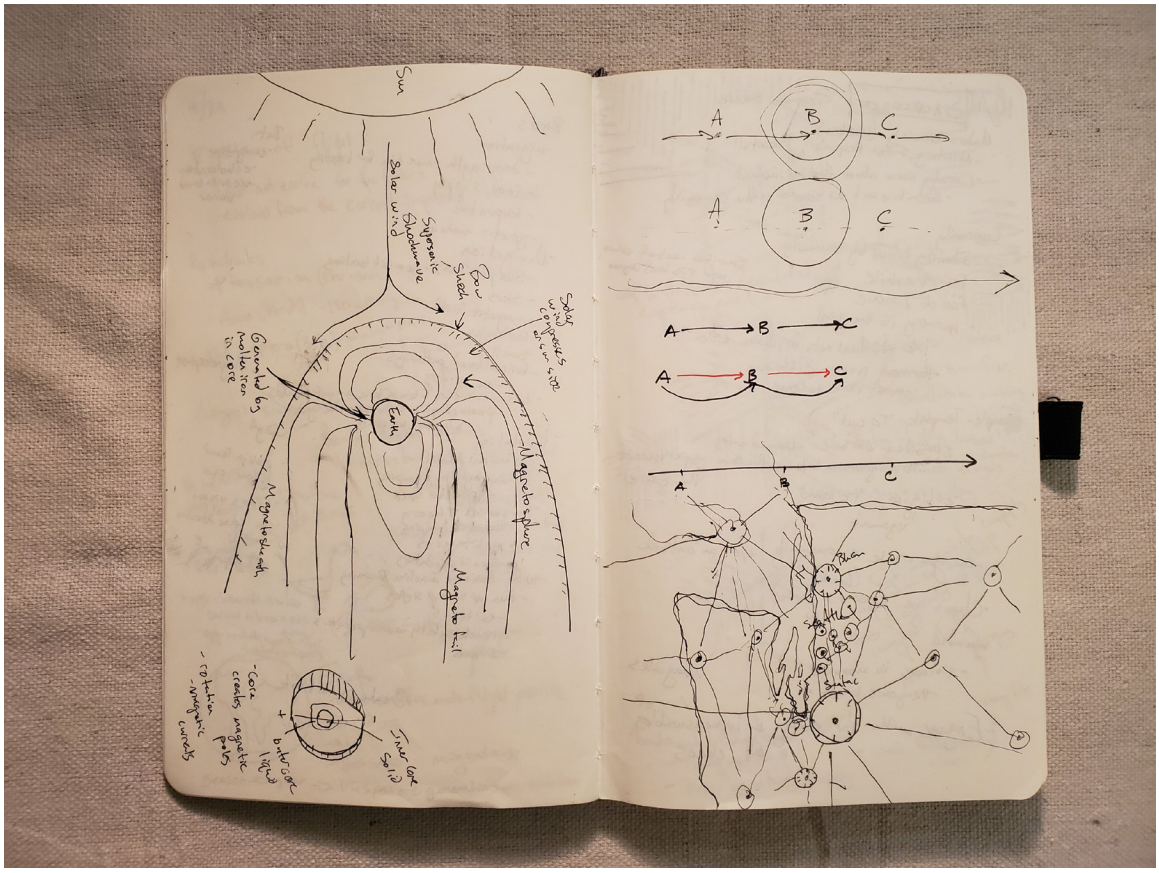

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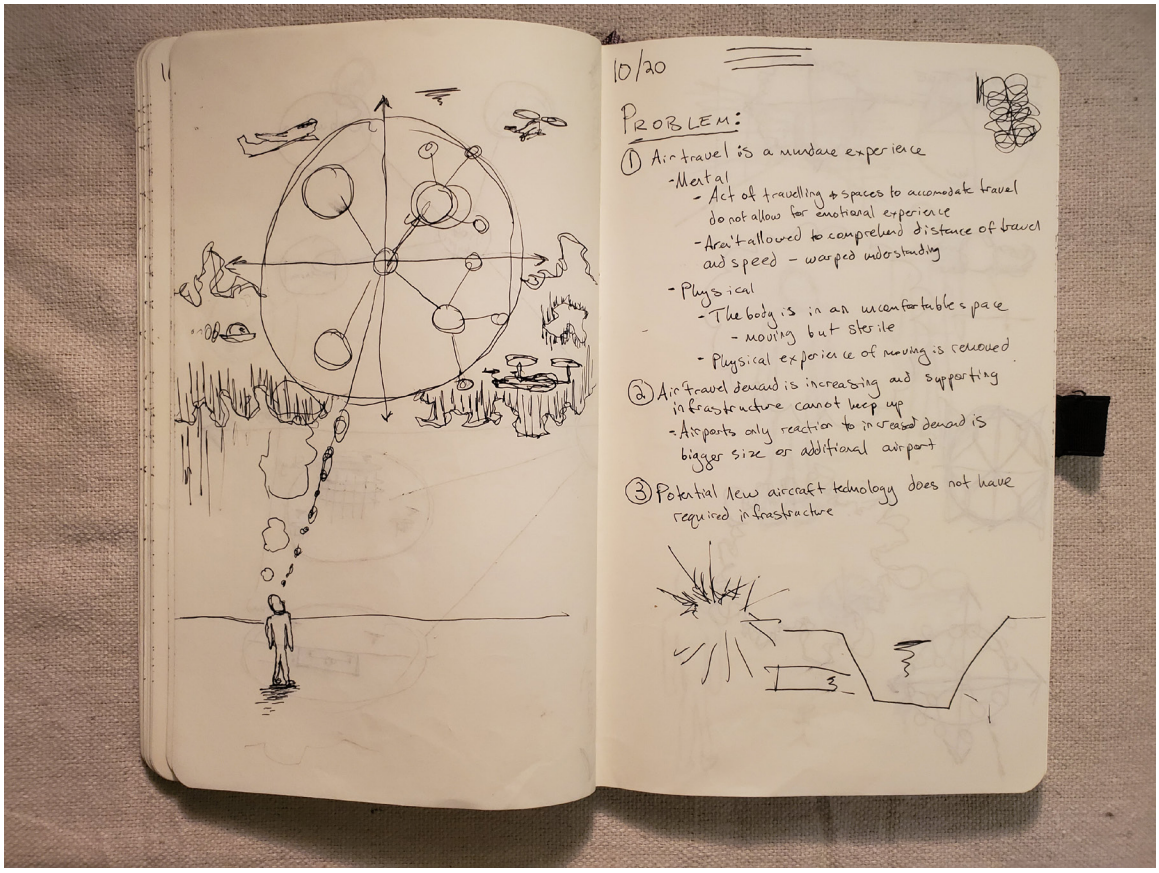

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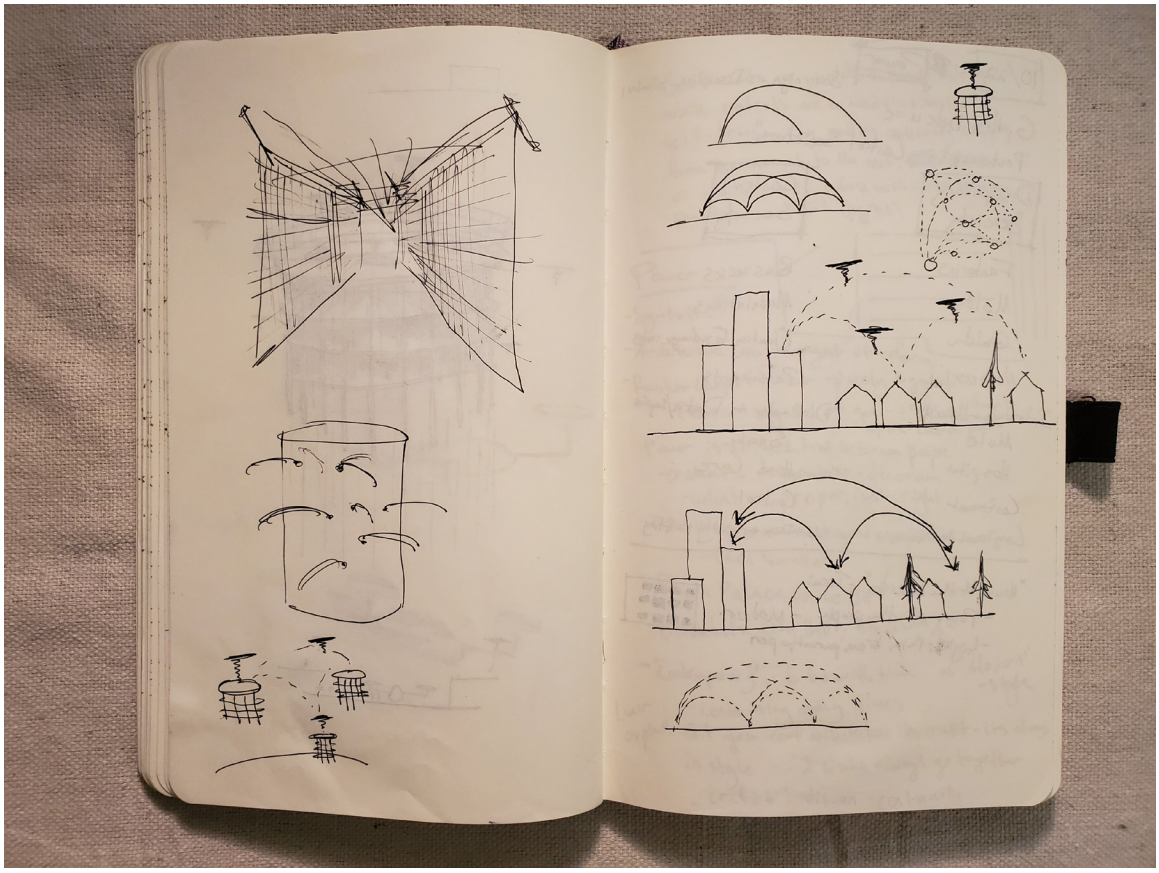

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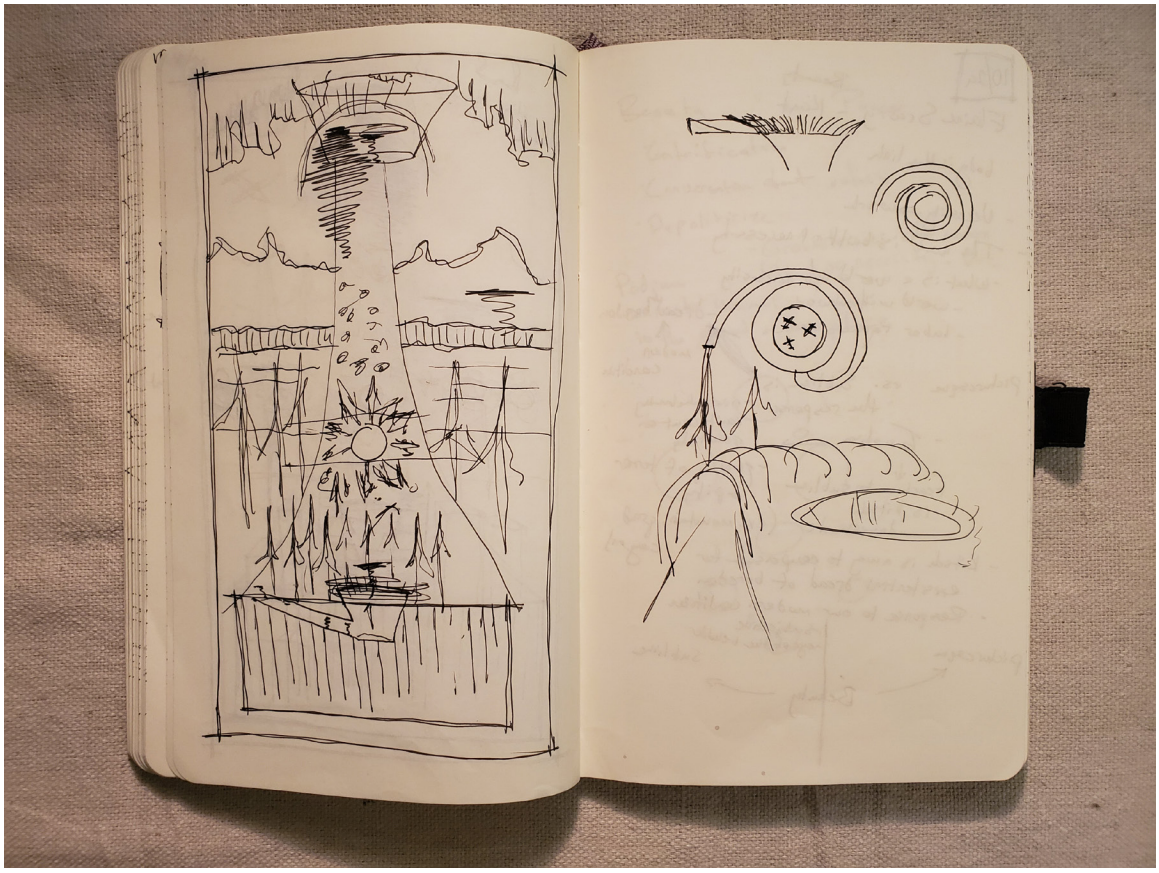

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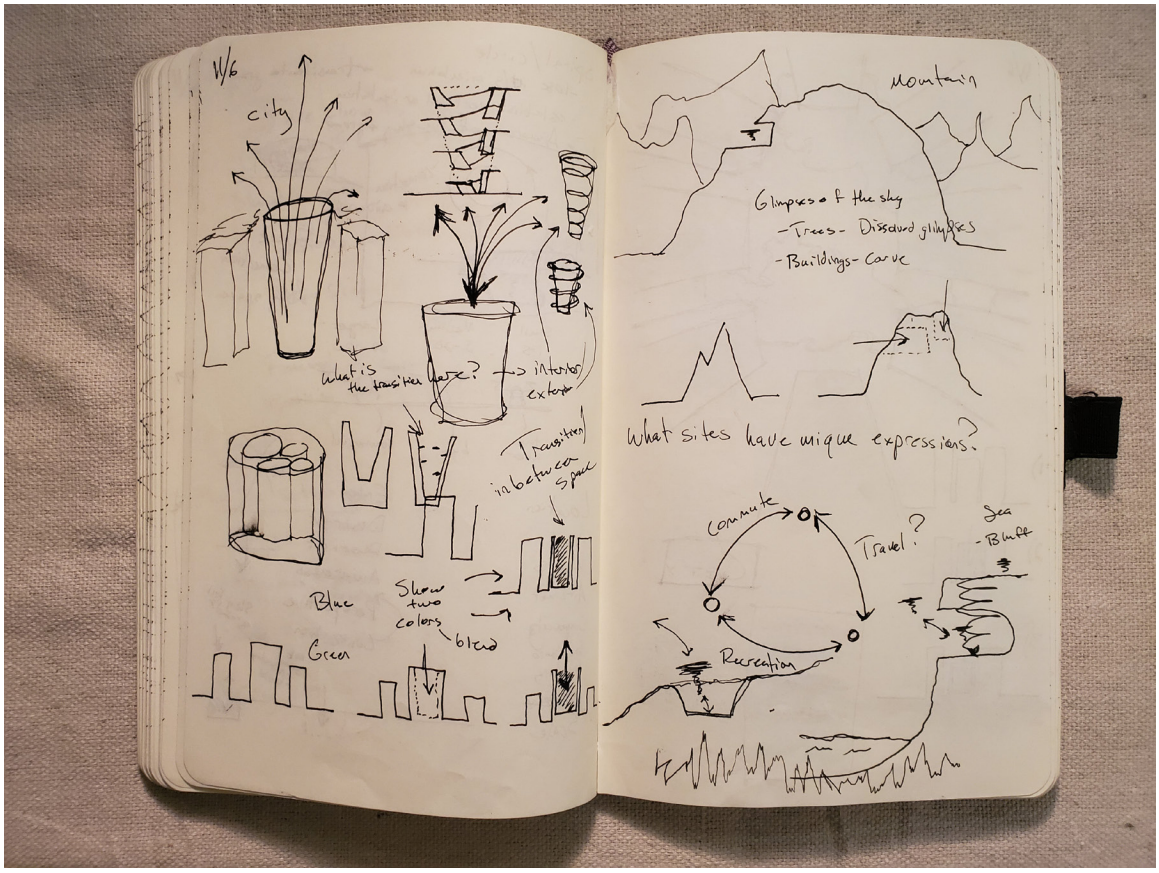

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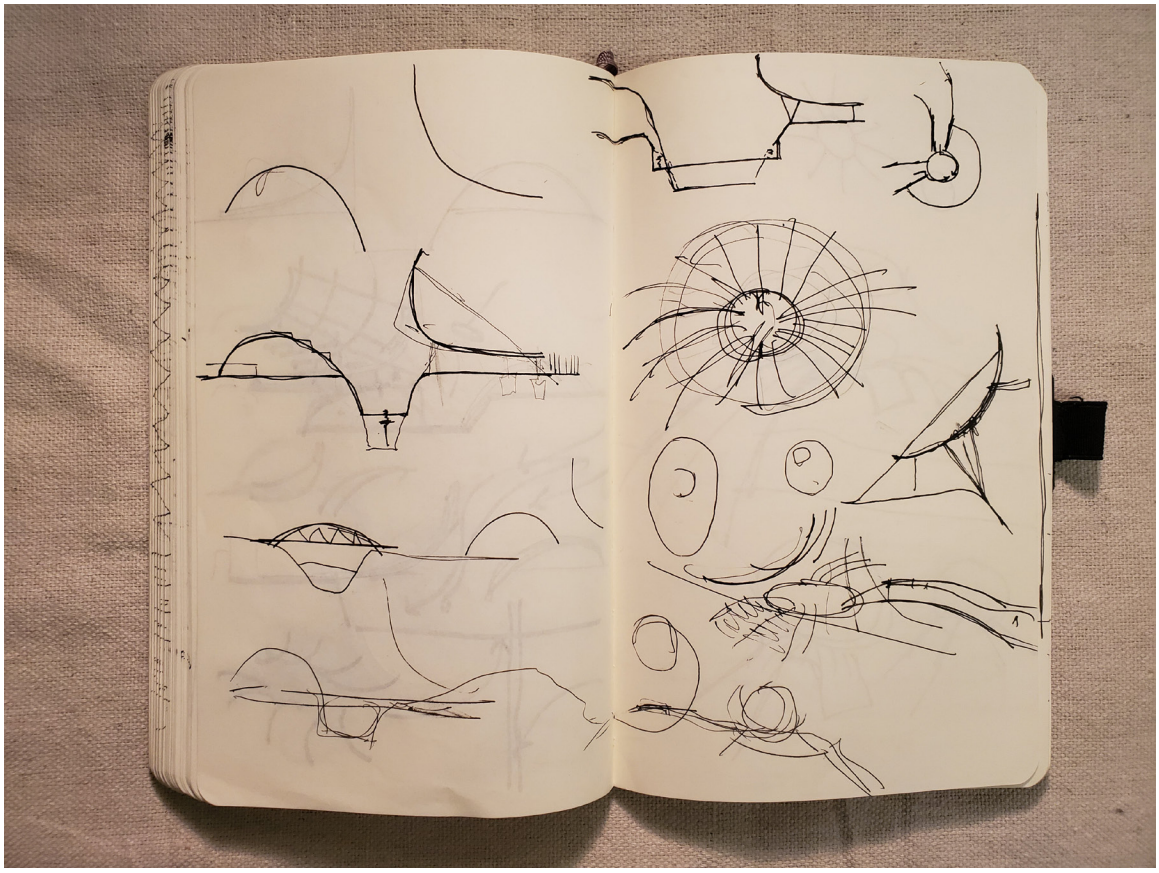

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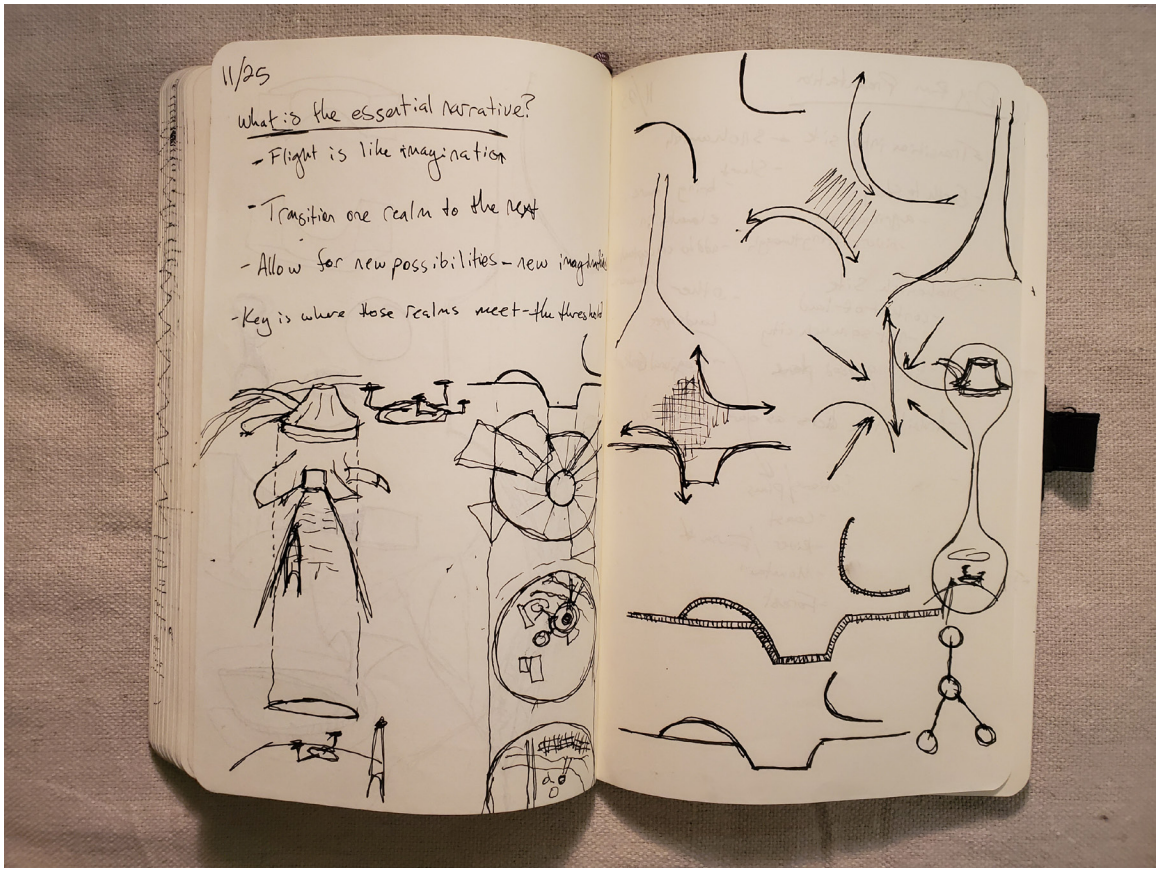

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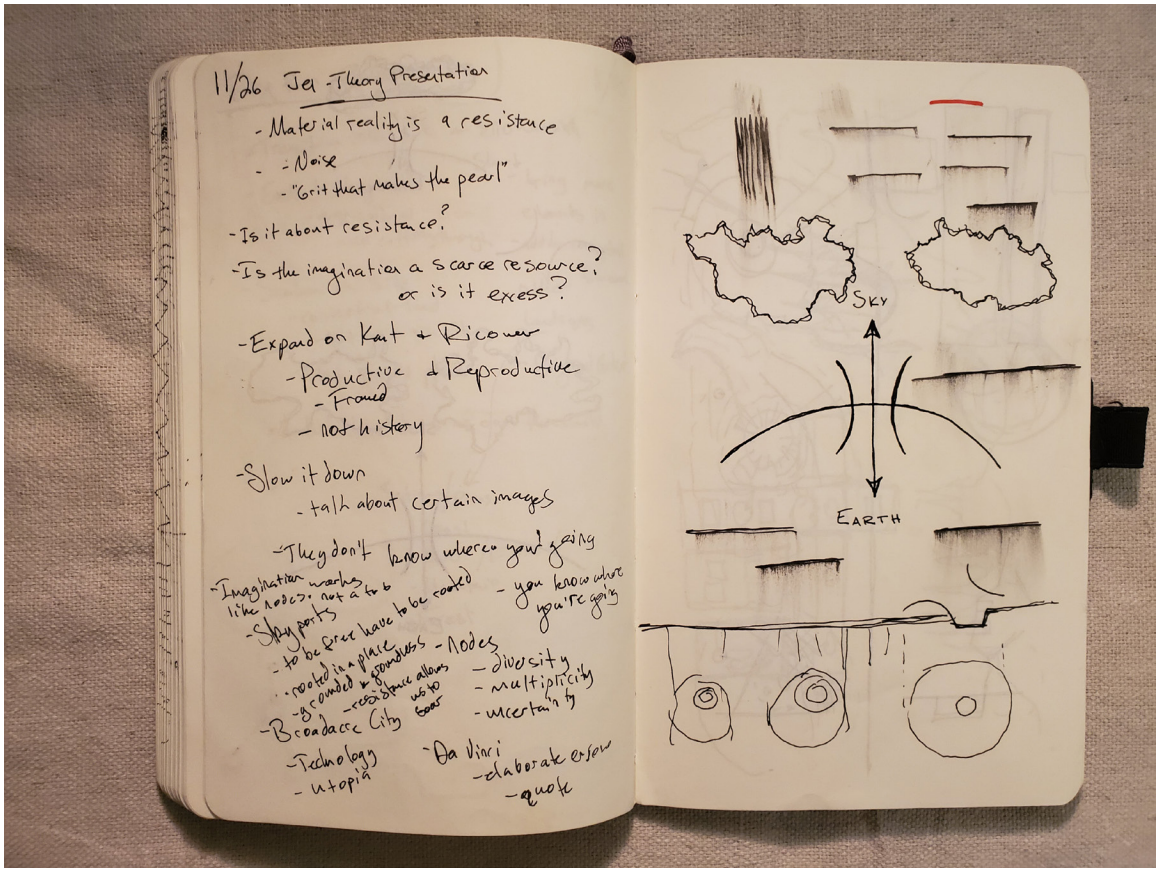

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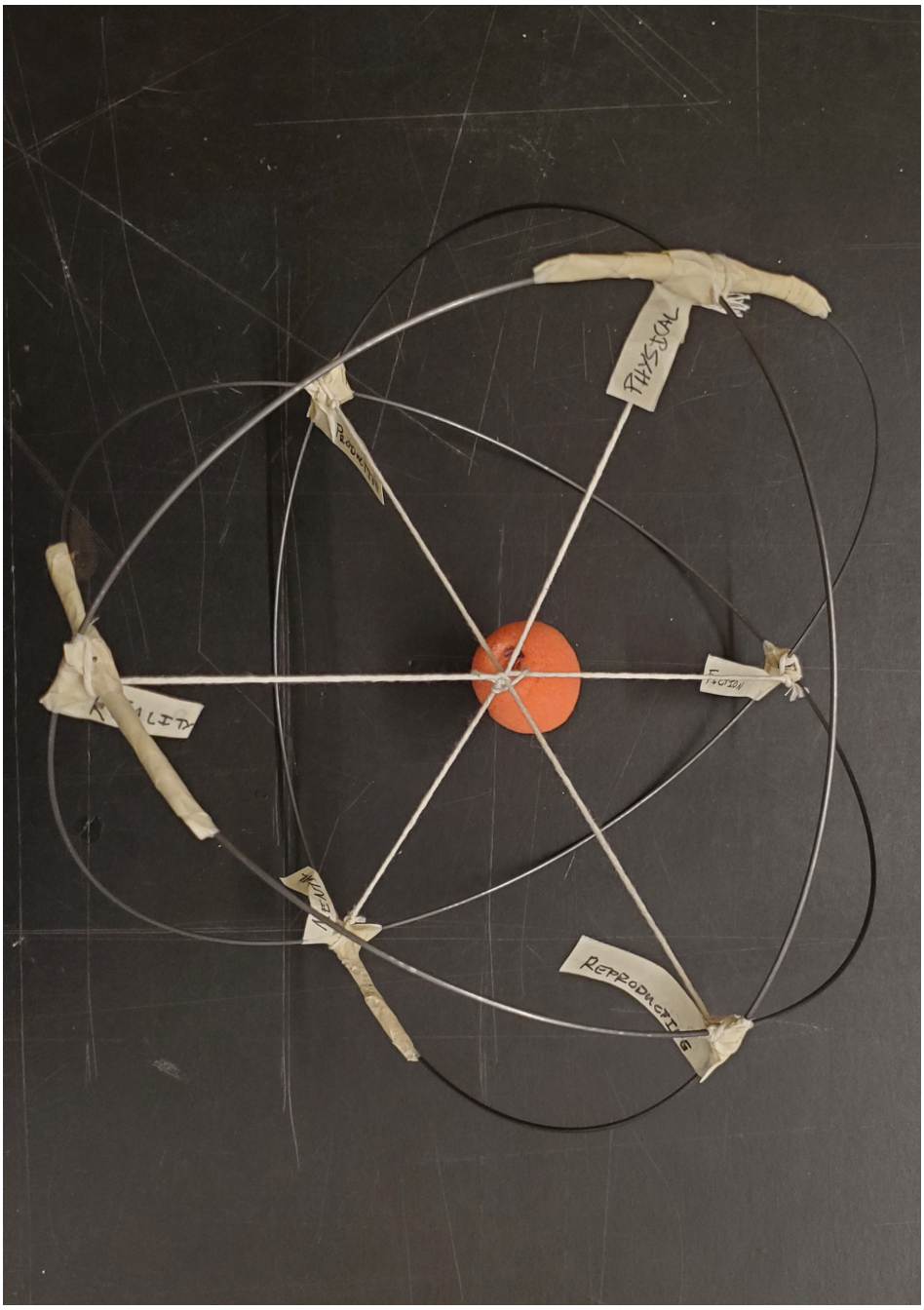

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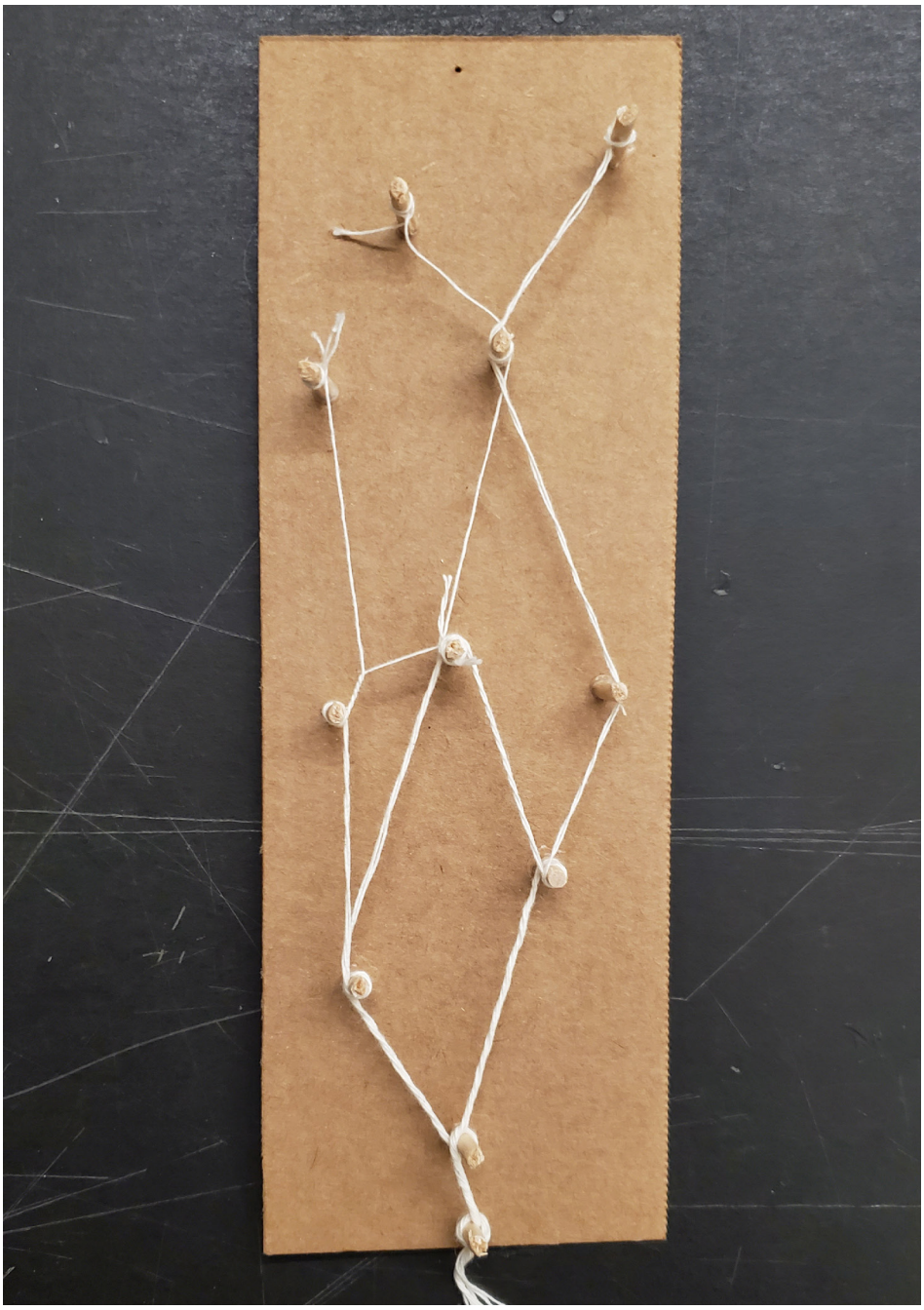

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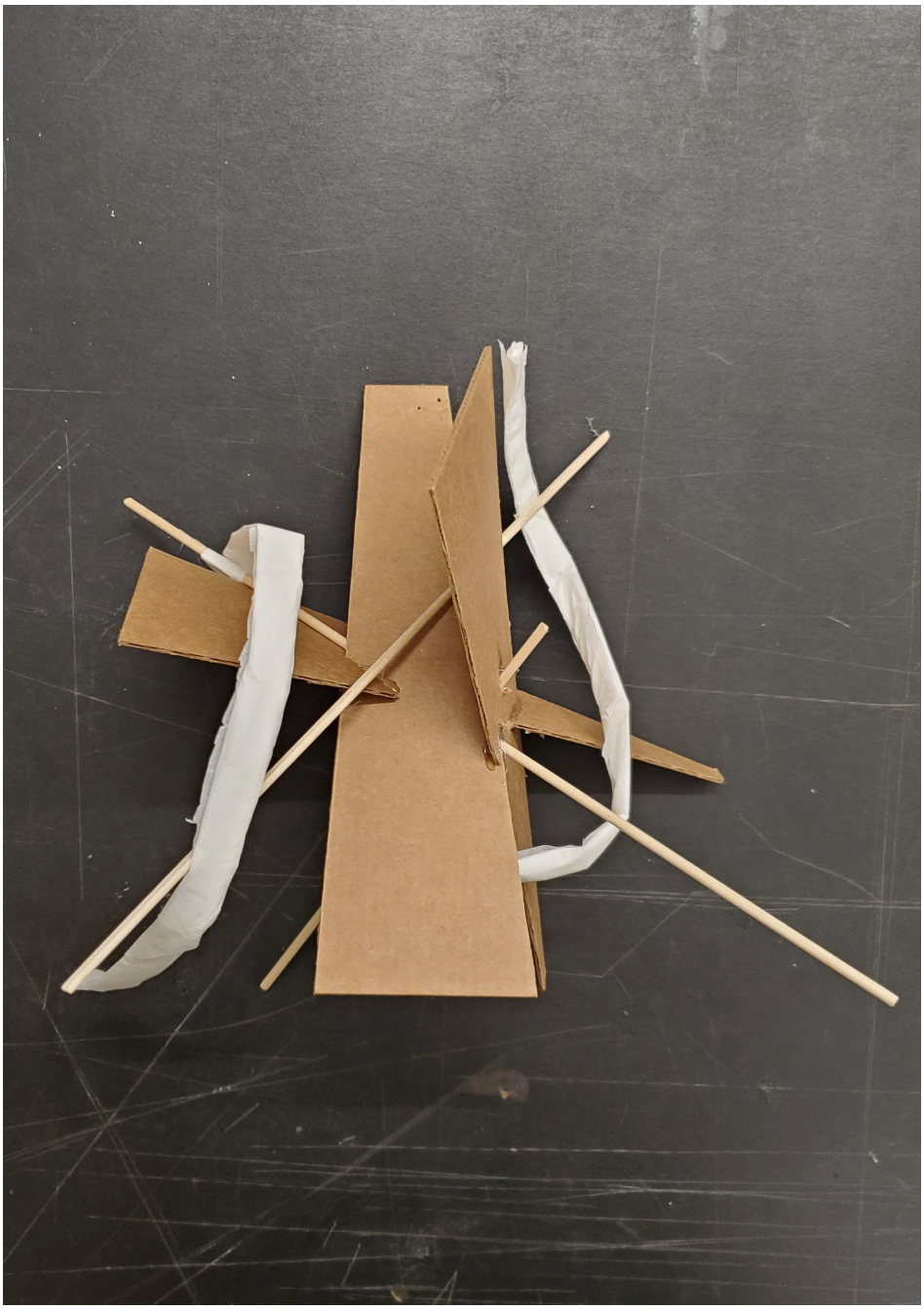
fig. 100 Study Model 3



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