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Leading Edge

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“LEADING EDGE”

A Thesis

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Degree

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ABSTRACT

I was introduced to the airplane at a young age through my father. Since that time I have been obsessed with airplanes. Wanting to be like my father in my youth, I became interested in the construction of these machines. I would spend hours working in the shop with my dad on airplanes and learning the specific structures that made up all sorts of different aircrafts. As I grew older I became fascinated with the history of aviation and where the idea of flight originated. It was this passion and knowledge that led me to my current body of work.

This thesis explores the different types of inspiration that the bird had on the development of the airplane. Though birds and humans can both achieve flight, they do so very differently. “Leading Edge” combines elements from both avian and aviation wings. The flight of a bird is very fluid and graceful where as humankind’s version of flight is industrial and static. Bringing the themes together produces visually interesting designs that combine hard metal edges with softer organic compositions. I find a certain beauty in the contrast between industrial and organic forms when they become melded together. This work investigates the structure of a bird’s wing as it moves in flight, a phenomenon which also provided a template for the development of aviation through curious artists such as Leonardo da Vinci. By contrasting the industrial and organic forms I strive to create artistically appealing compositions that will speak to a broad group of people, while evoking a subtle appreciation for the avian and aviation genre.

DEDICATION

This work is dedicated to my parents Scott and Blanche Thibodaux. Without their support none of this would have been possible. I would also like to dedicate this work to the art faculty at Nicholls State University for encouraging me to take my studies to the next level.

ACKNOWLEDGMENTS

I would like to thank the members of my thesis committee Durant Thompson, Kris Belden-Adams, and Andrew Smith for providing their artistic insight and criticism of my artwork. I would also like to thank Michael Williams for introducing me to sculpture and pushing me to the next level in my education.

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CHAPTER 1

LEADING EDGE

Throughout history, humankind has looked to the bird as inspiration for designing contraptions that would eventually allow humans to achieve flight. My thesis project, *Leading Edge*, addresses avian and man-made flight while exploring the common ground and differences between the two. *Leading Edge* focuses on the wing components, more specifically the leading edge which is the part of the wing where lift starts (Figure 1). This edge is the part that splits the air into two different currents over the rest of the wing's surface. Though the wings of birds and the airplanes create lift in different manners, they both share the leading edge.

The research for this body of work began with investigating older airplane designs. I noticed parts and shapes in these designs that closely resembled the anatomy of a bird's wing. As the work evolved I began to focus more on the bird in order to find a place of equilibrium between the mechanical and avian qualities. The work not only activates the its immediate surroundings, but also shows the lineage of the airplane, and the bird's involvement with its conception and development.

CHAPTER 2

THE DREAM OF FLIGHT

Humankind always has been fascinated with flight. This interest in flight inspired the mythological story of "Daedalus and Icarus." In the story, Daedalus is imprisoned for the murder of his nephew. In his time as a slave to King Minos, Daedalus built the Labyrinth to imprison the Minotaur.[1] During this time, Daedalus had a son named Icarus. Eventually, the king sentenced them both to the Labyrinth for giving away the secret of the maze to King Theseus.[2] Daedalus devised a plan to escape imprisonment by making a pair of wings out of wax and feathers for Icarus and himself. Daedalus then warns Icarus not to fly too low or too high, or else the wax would melt. [3] Overjoyed by the sensation of flight Icarus flew too close to the sun, which melted the wax and caused Icarus to fall to his death.[4]

Even though we know now that Icarus's wings could not lift a human being's weight, we are aware that the motion of human flight was directly influenced by the bird wing form. The moral of Icarus's story is to not be overly arrogant, because it might be the death of you. This did not slow down future inventors. Humankind's obsession with flight was greater than their fear of death and they continued to experiment with aviation.

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[1] Peabody, Josephine Preston. "Icarus and Daedalus." *Old Greek Folk Stories Told Anew*, 11-12. Boston: Houghton, Mifflin 1897. Pg 11
[2] Ibid Pg 11
[3] Ibid Pg 11
[4] Ibid Pg 12

CHAPTER 3

ARTISTIC INFLUENCES

Only two people attempted to create flying machines prior to da Vinci. Among them, Abbas Ibn Firnas (810-888C.E.) of Islamic Spain designed a glider that resembled a set of bird wings.[5] According to records, Firnas successfully glided on these wings, however his landing was a failure and he did not make another attempt for the remainder of his life.[6] In hindsight, Firnas realized that he did not incorporate a tail into his design, which caused him to plummet too quickly and then crash. Firnas made this realization, after watching birds land.[7]

In the Italian Renaissance, humankind's fascination with flight was recorded most famously by artist Leonardo da Vinci (1452-1519). Although none of his "flying machines" were ever built in his lifetime, they defiantly inspired the future pioneers of flight. Da Vinci's first design consisted of an all-wood frame with canvas stretched over it to simulate the structure of a bird wing with skeletal support.[8] After studying birds in more depth, da Vinci's subsequent designs focused on the act of gliding, rather than having man produce the power to obtain lift.[9] Instead of looking at the way a bird flapped its wings to take flight, da Vinci looked at the way a

[5] Walker, Ernest Edward. "The Development of the Art and Science of Human Flight." In *Aviation: Or Human Flight Through the Ages*, 17-18. Peyton, Colorado: Aeronautics Education Foundation, 1939. Pg 17
[6] Ibid Pg 17
[7] Ibid Pg 18
[8] Laurenza, Domenico. "Flying Machines." In *Leonardo's Machines: Da Vinci's Inventions Reveald*, 26-69. Florance-Milan: David & Charles, 2006. Pg 28
[9] Ibid Pg 29

bird might spread its wings to glide.[10] Not only was he looking at the way the bird held its wings during the glide, but da Vinci considered the movements of the tail, as well. Many of his designs incorporated a bird-like tail to the glider form. His flying machine designs were less about imitating nature and more machine-like. [11] Da Vinci's later designs incorporated a set of fixed wings as opposed to a set of wings that were flapped with an assortment of pulleys and cables (Figures 2 and 3).

Da Vinci's sketches of the flying machines are a biomechanical blend that resembles the imaginary result of the act of disassembling an airplane wing and reassembling it as a bird wing. Da Vinci's designs were heavily influenced by bird forms. Without his meticulous studies of birds, he likely would never have reached his conclusion about the primal importance of the glider, which became the basis for modern aviation.

Another influential force on my work is Etienne-Jules Marey (1830-1904), a photographer who made images of people and animals in motion with the use of stop-action photography. He photographed birds in flight and showed the individual stages of the moment of a bird's wing mid-flight. Marey had several methods for capturing the flight of a bird during flight. He had a contraption that was part-rifle part-camera that the "photographic gun."[12] This method proved to be very educational because for the first time ever people were able to see most of the individual stages of a bird's wing in flight. Marey didn't stop there with the experiments. He actually came up with a machine that measured the frequency of the movements of the wing as well as the duration of the bird's elevation.[13] Through the combination of the data and the photographs gathered, Marey was able to construct mechanical bird that would closely

[10] Ibid Pg 40
[11] Ibid Pg 40
[12] Braun, Marta. *Picturing Time: The Work of Etienne-Jules Marey (1830-1904)*. Chicago: University of Chicago Press, 1994. Pg 60
[13] Ibid Pg 34

imitate a bird in flight.[14] Seeing the individual stages of the bird's wing in flight allowed me to create individual models that represented each stage of those movements. The gestural movements of the bird's wing had become a big part of my concept at that point. Each of the stages that were represented in Marey's photographs became potential sculptures for me. Like Marey's experiments, the work was trying to closely imitate the movement of a bird's wing frozen in time in order to give the work a more organic feel.

[14] Ibid Pg 38

CHAPTER 4

HISTORICAL INFLUENCES

In the late-nineteenth century and early-twentieth centuries, several people made successful gliders, including, bicycle builders Wilbur and Orville Wright. The Wright Brothers gained experience as bike designers which later enabled them to design a better glider with a more advanced control system than others at the time.[15] This design had a biomechanical feel to it in the way that it was controlled. The wings warped similar to the way that a bird's wing would warp when in a glide. However, the rest of the control surfaces made hinged movements. Eventually, the Wright Brothers completed their prototype and tested the plane on December 17, 1903.[16] The flight was successful and the Wright Brothers were credited as the first to build and operate an airplane. The "Wright Flyer" used a unique control method called wing warping which is a design that allows birds to bank right or left. The Wright Brothers design integrated Bernoulli's Principle. This principle was first applied to hydrodynamics and states that when air moves over the top of a curved surface faster than it does along the flat bottom surface it will result in an upward thrust.[17] A bird's wing feathers can easily form to Bernoulli's Principle when gliding. This curve is known as the airfoil.[18] *Leading Edge* makes references to the airfoils that the Wright Brothers and other subsequent aviation pioneers used in their designs.

In the years following the Wright Brothers the airplane began to rapidly evolve due to its involvement in World War I. Improvements in aerodynamics and more powerful engines made

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[15] Reynolds, Quentin James, and Jacob Landau. *The Wright Brothers: Pioneers of American Aviation*. New York: Random House, 1950. Pg 30

[16] Ibid Pg 50

[17] Bernoulli's Principle: a principle in hydrodynamics: the pressure in a stream of fluid is reached as the speed of the flow is increased. From Merriam-Webster. Accessed May 1, 2015. http://www.merriam-webster.com/dictionary/bernoulli's principle.

[18] Airfoil: a body (as an airplane wing or propeller blade) designed to provide a desired reaction force when in motion relative to the surrounding air. From Merriam-Webster. Accessed May 1, 2015. http://www.merriam-webster.com/dictionary/bernoulli's principle

the planes stronger, faster, and more efficient. At this time, an airplane often became obsolete within six months of its release. The airplane became a machine, or a multi-role tool for humankind. With the mechanical and technological advancements, the influence of the bird was starting to fade. The airfoil shapes changed to a point where control structures of wings were no longer organically moving surfaces, but became comprised of hinged mechanical parts. These new standards improved the maneuverability of the airplane and increased the strength of the plane's structure.

Although today's airplane has lost many of the connections it shared with the bird, new technology and designs are beginning to bring those connections back. Advancements in materials and the way modern planes are being designed continue to have with the bird in mind. Most of these advancements deal with maneuverability and re-incorporating the organic movement of wing warping. Although the airplane has often lost its direct connection to the bird, it will likely always maintain the element of a leading edge.

CHAPTER 5

CONCEPTUAL DEVELOPMENT

Leading Edge focuses on the blending of avian and mechanical elements that meld the hard edges of the industrial world with the soft flowing edges of the avian species. The airplane wing becomes a biomorphic shape, and vice-versa.

Construction started with the pieces *Wing 1*and *Wing 2* [PLATES 1 and 2]. These are the earliest rendition of my research. *Wing 1* and *Wing 2* started off with an idea of disassembling an airplane's wing with a flat-bottom airfoil (Figure 4) and then reassembling it into a form that resembles a bird's wing. These pieces really push the industrial motif, which in turn felt too stiff. The leading edges are the only areas of these pieces that are biomorphic. In order to bring the bird motif back into these pieces, I had to draw more attention to the organic areas; aluminum sheeting with a swirl pattern burnished into it was used to achieve this. Not only did the aluminum draw attention back to these areas, it also focused importance on the leading edge.

Upon completion of *Wing 1* and *Wing 2*, I realized that the influence of the airplane was overshadowing the bird motif. I did more research on airplane wings and came across the under-cambered airfoil (Figure 5). This airfoil shape lends itself to the bird better than the traditional flat-bottom airfoil used in *Wing 1* and *Wing 2*. After settling on this design, I made several cardboard maquettes [PLATE 3]. Through further experimentation with the cardboard, I decided

to make more maquettes utilizing two wings, as opposed to the one wing designs. This allowed me to incorporate a more complete bird gesture in these designs [PLATE 4].

After experimenting with the maquettes, I felt that I had a sufficient amount of new ideas to start making these pieces on a larger scale. Looking at the models I realized that they would scale up nicely and some would have a nice outdoor presence. The piece *Swoop* [PLATE 7] was born with this idea in mind. It was at this point in the work that I realized that these pieces started to evoke particular feelings based upon their gestures.

While working on *Swoop*, I decided to make another indoor piece with the same ideas in mind. I wanted this piece to have a more intimate feeling as it was to be placed in a smaller space. I also decided to return to a single-wing design that I experimented with ideas from the cardboard maquettes. *Descend* [PLATE 8] was the next piece made in this body of work. With this piece I took a new approach to its base support. Unlike in the earlier pieces that were placed on their trailing edges (Figure 1), *Descend* was positioned on its leading edge to give it the appearance of being in flight.

The manifestations of these new sculptures lead to the Formation series [PLATE 9]. Originally, they were all going to utilize five wing sections as seen in *Formation 1* [PLATE 9] and *Formation 2* [PLATE 10]. As I was working through this series, I realized that using less wing sections could also be compositionally interesting. They became less wing-like and more formal and figurative [PLATE 11]. I continued to reduce the wing sections until got down to one. I then realized that this form could stand on its own and still have enough visual interest to be a visually interesting sculpture. *Wing Rib* [PLATE 13] came from this idea. *Wing Rib's* stance starts to become figurative and skews the farthest away from the original concept of the earlier pieces.

Looking at the work as a whole, I noticed that the narrative of the bird had grown very strong in the work. I added prints [PLATES 14-17] that utilized aircraft blueprints to balance the avian with the industrial. Each blueprint shows structural elements that depict materials used in the aviation industry that appear in the sculptural work. These prints were made by stretching airplane fabric over a metal frame to serve as a base for the screen print. The airplane blueprints were then screen printed on to the fabric. The drawing components depict the objects that were used to fly in their corresponding myths, these were then layered behind the prints to contrast one another. Rivets and pieces of copper were then used to accent to composition and move the viewer visually through the composition.

I made this work to share my passion of aviation with the viewer, much like my father shared his love of aviation with me as a child. In closing, I want the viewer to gain an appreciation for flight and its origin, the bird. I also want them to have an appreciation for the formal qualities of the work through elements of design such as repetition, variation, distribution of visual weight and the use of positive and negative space.

CHAPTER 6

DESCRIPTIVE ANALYSIS

Leading Edge consists of nine full-scale sculptures, four screen prints, and seven preliminary maquettes. All of the work deals with the inspiration of the bird on the development of aviation. This is realized in a similar manner for each piece, however the work goes through several stages. The overall installation shows the evolution of the work which in a way mirrors the different stages and developments of aviation throughout history. As a whole the work tells a story of process beginning with a concept and evolving into pieces that could potentially explore my next body of work.

*Wing 1*and *Wing 2*

The works *Wing 1* and *Wing 2* are the jumping-off points for the concept development in the rest of the thesis work. By taking an individual airplane wing's sections and splaying, them out on the leading edge, a form that loosely resembles a bird wing was created. The airplane motif is prevalent and almost overshadows the bird motif in both of these works. Since these pieces are based so heavily on the airplane, they have a ridged appearance, with the leading edge being the only part on both that feels organic. This was accented by burnishing the aluminum to show the importance of the leading edge and also to show the commonality between the wings of a bird and an airplane. The paint applied to *Wing 1* is a direct reference to structural finishes used in the aviation industry. *Wing 2*, on the other hand, uses a textured paint that not only references industry, but also the organic side of the bird.

Wing 1
Steel and aluminum
2015

[PLATE 1]

Wing 2
Steel and aluminum
2015

[PLATE 2]

Conceptual studies

The conceptual studies are made up of several maguettes that were created after *Wing 1* and *Wing 2*. These studies mark the beginning of the first evolutionary step in my thesis. The element that changed in the maquettes was the use of the under cambered-airfoil as opposed to the flat bottom airfoil, which was utilized in earlier pieces. In addition these pieces used individual wing ribs and not complete sections of an airplane's wing. This created the illusion of individual feathers. Each model in this series was made with the intention to later increase the scale. They serve as preliminary mock-ups and some of them were also used in the creation of larger pieces. They are made of cardboard because the material is easily manipulated and aids in the rapid realization of ideas.

Conceptual studies
Cardboard
2015

[PLATE 3]

Swoop (model)
Cardboard
2015

[PLATE 4]

Prey
Cardboard
2015

[PLATE 5]

Scavenger
Cardboard
2015

[PLATE 6]

Swoop and *Descend*

The pieces *Swoop* and *Descend* were born from two of the maquettes developed in conceptual studies. The bird motif is prevalent in these two pieces. *Swoop,* was developed first as an outdoor piece. It utilizes the under-cambered airfoil just like its model does, but on a much larger scale. The large scale helps the sculpture interact with the space around it while evoking an emotion that the other pieces lacked. This piece has an intimidating feel. However, I still wanted the viewer to interact with the piece by walking through and under it. This piece is the first in this body of work to feature two wings and incorporates an actual pose that a bird of prey uses to catch food. The trailing edges of the two outermost sections on both sides are flipped up to compliment the bird-like gesture of *Swoop.* This was a change made from the model for aesthetic purposes.

I consider *Descend* to be the turning point for the show. It is the first to utilize a base and has more contact with the floor than any of the pieces before it. The stance of *Descend* is sitting on the leading edge to show the second stage of evolution in this body of work. This piece features a similar construction to *Swoop,* but it has a more intimate as an indoor piece. *Descend* was painted in a fashion that compliments this evolution in the work. The textured brown fades to grey on the trailing edges which revert back to the bird as well as diverting attention away from the leading edge. This signifies the metaphorical death of the leading edge in the body of work. *Descend* is the last piece that literally adheres the bird wing in this body of work.

Swoop
Steel
2015

[PLATE 7]

Descend
Steel
2015

[PLATE 8]

FORMATION SERIES

The formation series makes another significant shift in the work. It continues to build off the wing forms of of *Descend*. However, the concept started to morph into something that lead into my next body of work. This series started to focus more on the overall bird wing form and what could be created by using airfoil shapes. The pieces were going to utilize five wing sections in each. However, as work progressed to a point where on them, I realized that less could be used in the final forms. Subtracting these sections drastically changed the concept of the pieces. The work started to take on a more figurative stance. With each section that was omitted, the form also started to look less like a wing. The form of the under-cambered airfoil itself had enough visual interest to stand on its own. *Wing Rib* is the example of this. It begins to resemble a column-like form. Its simplicity also began to have visual strength. The figurative feel of *Wing Rib* could also be interpreted as a self-portrait that connects me to my passion for aviation.

This collection of work also shifts material, to wood, a material once used to build planes. Most of the early airplane structures that I am referencing utilized wood construction. The stained finished is reminiscent of the way that airplane builders would treat the wood to protect it from the elements on early aircraft. It also brings Leonardo da Vinci back around as an influence in the work being that all of his designs were made of wood and canvas.

Formation 1
Wood
2015

[PLATE 9]

Formation 2
Wood
2015

[PLATE 10]

Formation 3
Wood
2015

[PLATE 11]

Formation 4
Wood
2015

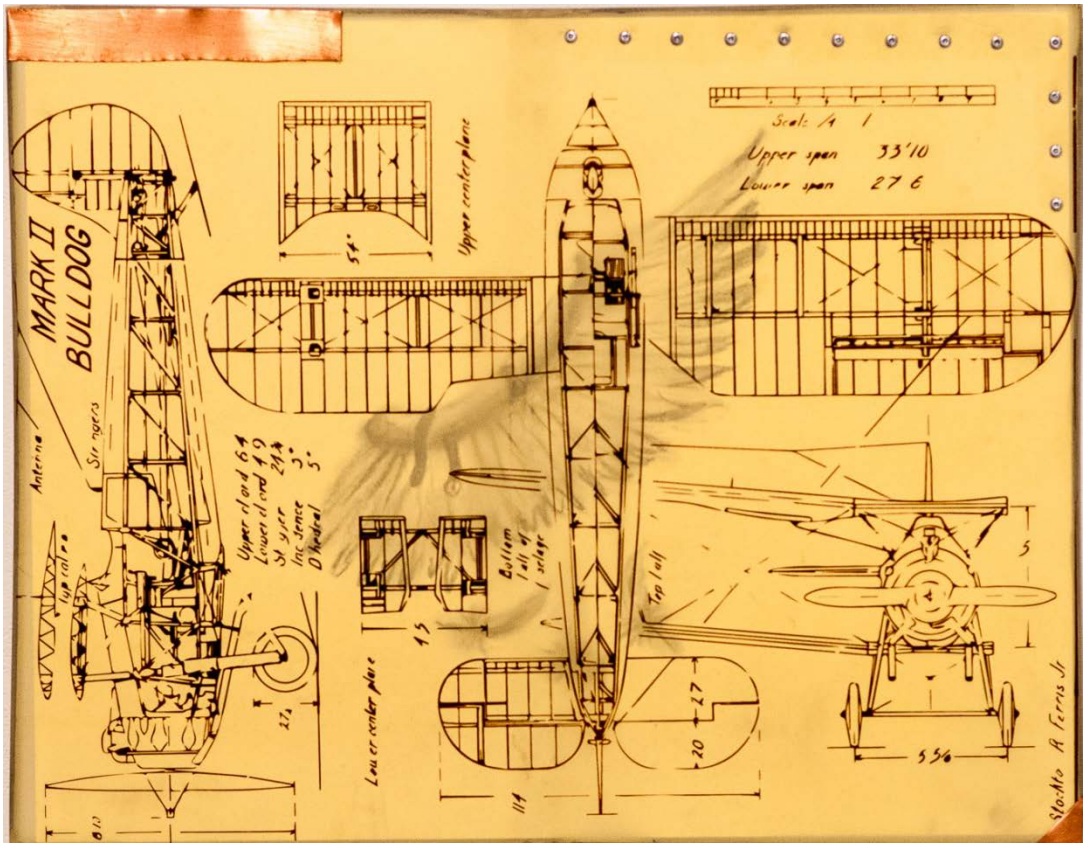
[PLATE 12]

Wing Rib
Wood
2015

[PLATE 13]

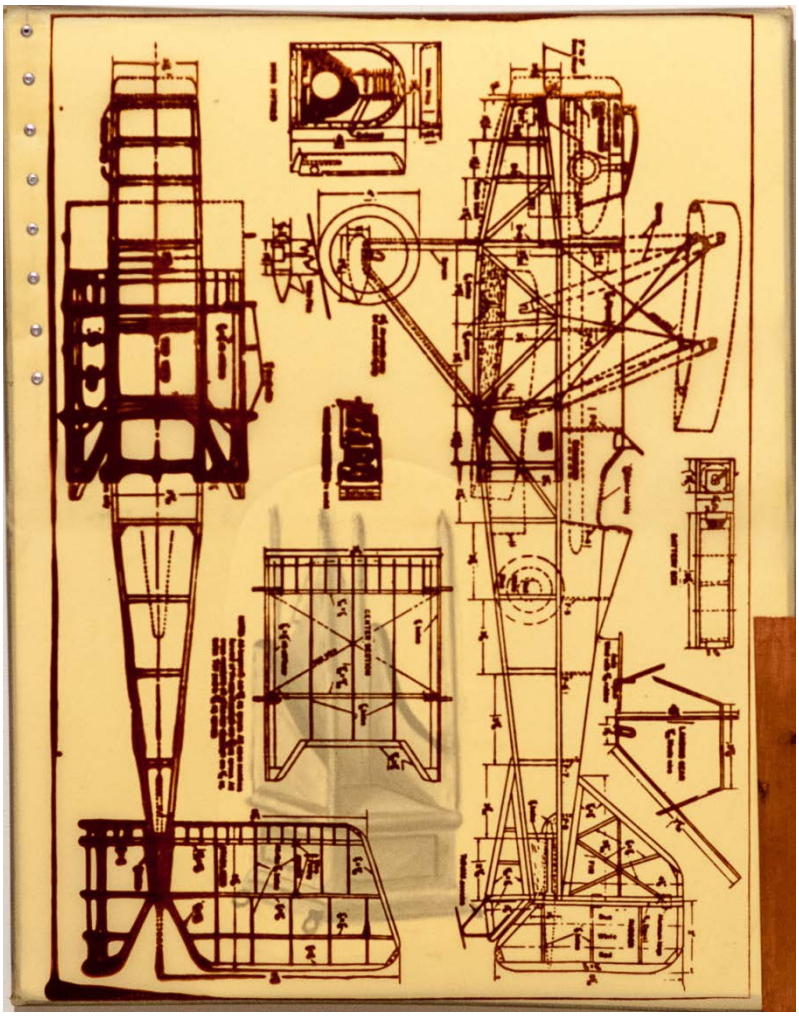
PRINTS

The prints deal with ancient myths that involve flight. They depict the mechanisms that allowed the characters in these myths attempt to fly. Those objects are juxtaposed with blueprints from actual airplanes to show the difference between fiction and non-fiction. The prints fit into the show as a whole to bring the airplane narrative back around to balance the rest. Since the later work started to focus more on the bird I thought it was necessary to introduce something that brought the structural airplane motif back around.



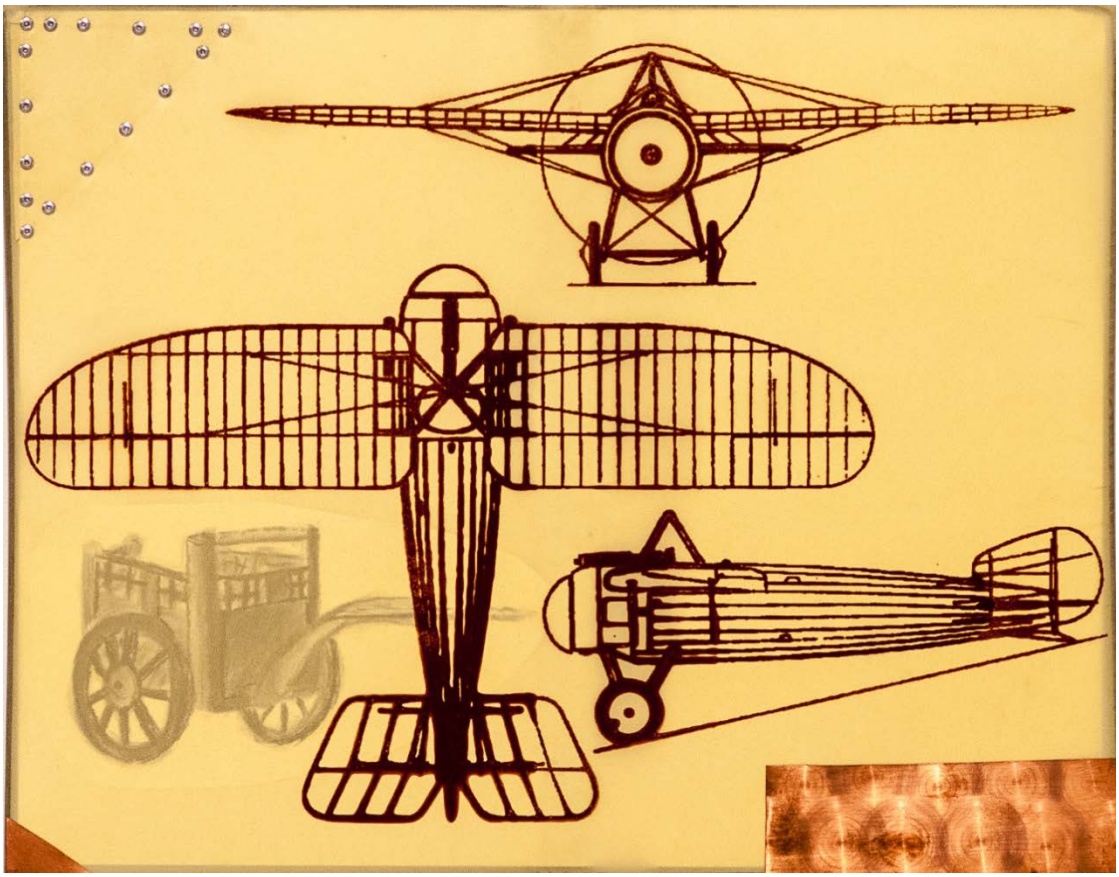
Don't Fly Too Close To the Sun
Solartex, rivets, copper, charcoal, ink
2015

[PLATE 14]



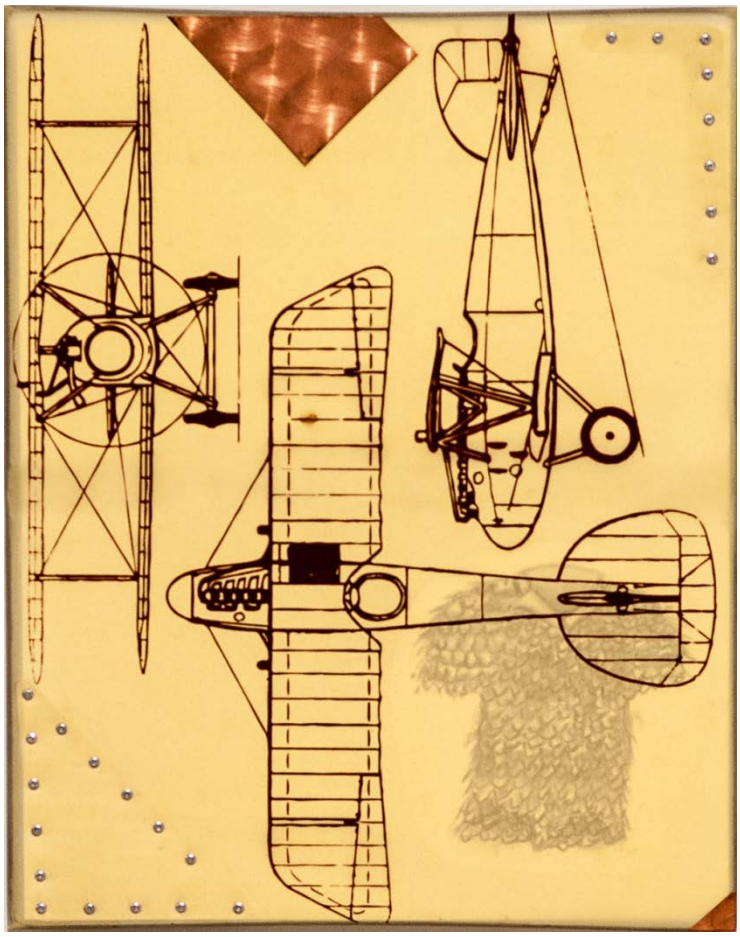
The Fool King
Solartex, rivets, copper, charcoal, ink
2015

[PLATE 15]



Chariots of the Sky
Solartex, rivets, copper, charcoal, ink
2015

[PLATE 16]



Wayland the Smith
Solartex, rivets, copper, charcoal, ink
2015

[PLATE 17]

CHAPTER 7

CONCLUSION

Looking back at this thesis as whole, I see the integration of the bird in the conception of aviation. The leading edge is the binding force between the bird and the airplane. The blending of animal and mechanical forms allows the viewer to have an appreciation for the subject matter and the overall design of the work. *Leading Edge* is a tribute to aviation as a whole and to the avian species for providing a template for the airplane.

Leading Edge also is an extension of what I have learned in the past three years. This series has forced me to look at concept and design with a more critical eye. This in turn brought forth technical challenges as I worked to enforce structural integrity while using different welding techniques. The solutions to these challenges allowed me to work with more advanced methods of fabrication, welding and woodworking.

As the work came to a close, I started to see an evolution in the formal qualities. These qualities became more figurative. This could lead into a series of self portraits that incorporate the forms that were used in this body of work. Future work could also be about human beings and the quest for flight.

BIBLIOGRAPHY

BIBLIOGRAPHY

Braun, Marta. *Picturing Time: The Work of Etienne-Jules Marey (1830-1904)*. Chicago: University of Chicago Press, 1994.

Laurenza, Domenico. "Flying Machines." In *Leonardo's Machines: Da Vinci's Inventions Reveald*. Florance-Milan: David & Charles, 2006. 26-69.

Peabody, Josephine Preston. "Icarus and Daedalus." In *Old Greek Folk Stories Told Anew*. Boston: Houghton, Mifflin, 1897. 11-12.

Reynolds, Quentin James, and Jacob Landau. *The Wright Brothers: Pioneers of American Aviation*. New York: Random House, 1950.

Walker, Ernest Edward. "The Development of the Art and Science of Human Flight." In *Aviation: Or Human Flight Through the Ages*. Peyton, Colorado: Aeronautics Education Foundation, 1939. 17-18.

LIST OF APPENDICES

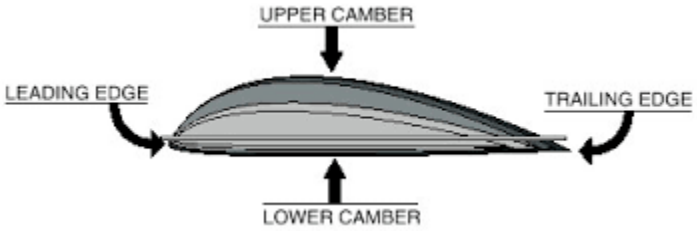


Figure 1: Unknown artist, Airfoil Shape Diagram, Wright Flyer Online, 4/29/2015, Public Domain (image credited to NASA Quest) Image labels the leading edge

Figure 2: Leonardo da Vinci, Flying Machine, da Vinci's personal notebooks, C. 1450, Public Domain. Image shows first design of da Vinci's flying machine.

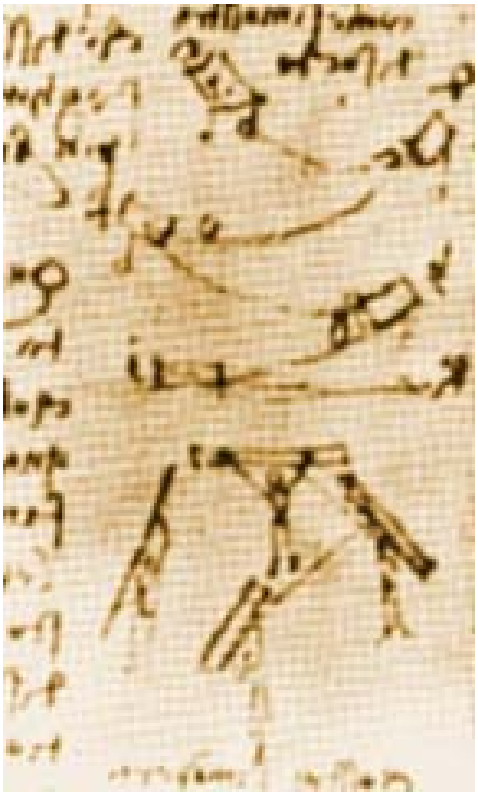
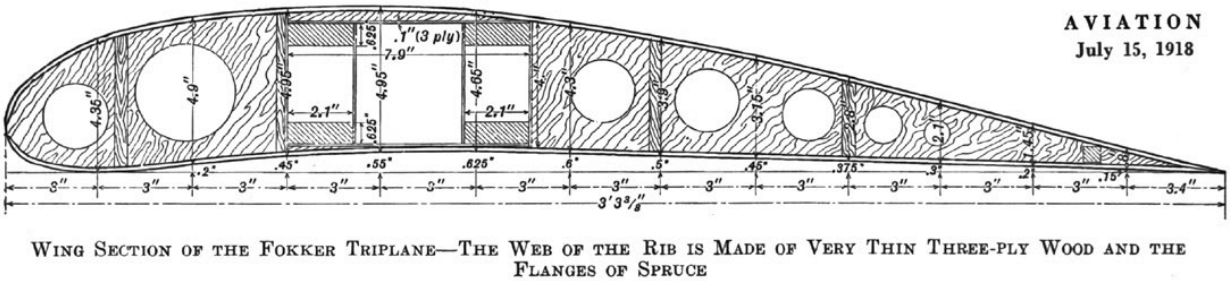


Figure 3: Leonardo da Vinci, Flying Machine, da Vinci's personal notebooks, C. 1450, Public Domain. Image shows early development sketch of da Vinci's glider design.

Figure 4: Unknown Artist, Flat Bottom Airfoil, pilot 3d, 4/29/2015, Public Domain (image credited pilot3d.com). Image shows shape of a flat bottom airfoil.



WING SECTION OF THE FOKKER TRIPLANE—THE WEB OF THE RIB IS MADE OF VERY THIN THREE-PLY WOOD AND THE FLANGES OF SPRUCE

Figure 5: Unknown artist, Under Cambered Airfoil, Wood Craft, 4/29/2015, Public Domain (Image Credited to woodcraft.science) Image shows the shape of the under cambered airfoil.

VITA

Seth Thibodaux was born in Thibodaux, Louisiana, where he spent his childhood and his early adult life. He graduated from Thibodaux High School in 2006. He then attended Nicholls State University, which is also located in Thibodaux, Louisiana. Thibodaux graduated with his BFA from Nicholls State University in the fall of 2011. While at Nicholls, he exhibited in several local and regional exhibitions, winning a scholarship to Arrowmont School of Arts and Craft in Gatlinburg, Tennessee, in early 2011.

Seth was accepted into the MFA program at The University of Mississippi in the fall of 2012. Since that time, his work has been featured in several local, regional, national, and international exhibitions, including the Talsi Regional Museum in Talsi, Latvia, for the *Savienosanas Coalescence* show, which was part of the *International Conference on Contemporary Cast Iron Art*. Seth was also a member of the steering committee for the *National Conference of Contemporary Cast Iron Art* at Sloss Furnaces in Birmingham, Alabama, in the spring of 2015. Thibodaux received his MFA from the University of Mississippi in May of 2015. At that time he had two sculptures featured in the inaugural year of the *Yokna Sculpture Trail* located in Oxford, Mississippi.