

Experimenting with Flight: Entering the Fray in the Pioneering Age of Flight

Warming Up

Do you play a sport like baseball, track, rowing, football, or soccer? Maybe you excel at other types of competitive gaming such as video games or chess? Or, maybe you have learned a sophisticated skill such as a foreign language or a computer programming language?

If any of these apply to you, and at least one likely does, consider the following questions:

- How did it take you to learn these skills?
- How long did it take for you to become proficient in these skills?
- What did that process look like?
- Did it involve more success than failure?
- How did you learn from your failures?

Pair up with a partner to discuss your answers to these questions. Did your partner have similar experiences? If not, why not?

Time permitting, draft a short report on your discussion and present your conclusions to the class.

Getting Started

The story of the Wright brothers soaring above the sands of Kitty Hawk is well known. As the story goes, the Wright Flyer skidded along the launching rail into swift headwinds and up into the air and the history books in December of 1903. This is true. But it is only a part of a much larger story. The larger picture includes years of painstaking testing, analysis, and careful observation on the part of the Wright brothers. And, beyond their dedicated efforts, there were also many others who worked for years and even decades to create flying machines. Some of these men even gave their lives in this effort.

Consider the case of Otto Lilienthal. Born in 1848 in Prussia, Lilienthal was fascinated with the idea of manned flight from an early age. As a young man, he and his brother went so far as to attach wings to their arms to try to fly. This effort, however, proved unsuccessful. Undeterred, Lilienthal continued to experiment with air resistance and methods of flight throughout his adulthood. By the year 1889, Lilienthal had accumulated enough knowledge about flight to publish his famous book, *Bird Flight as the Basis of Aviation*. But Lilienthal was not content to merely write about the effort; he also wanted to participate. Beginning in the year 1891, Lilienthal began testing a glider from dunes in Germany. Over the next few years, he made over 2,000 flights with his glider, accumulating a wealth of knowledge about gliding and flight as he did. Ultimately, Lilienthal would give his life in pursuit of this knowledge. While testing his glider on August 9, 1896, he fell from the sky and broke his back. He died from this injury just over a day later.



Otto Lilienthal gliding experiment, LOC Prints and Photographs Division;
<http://www.loc.gov/pictures/item/2002722087/>

Years later, Wilbur Wright would credit Lilienthal with being the single most important influence on his efforts, saying in 1912:

“No one equaled him in power to draw new recruits to the cause; no one equaled him in fullness and dearness of understanding of the principles of flight; no one did so much to convince the world of the advantages of curved wing surfaces; and no one did so much to transfer the problem of human flight to the open air where it belonged.

“As a missionary he was wonderful. He presented the cause of human flight to his readers so earnestly, so attractively, and so convincingly that it was difficult for anyone to resist the temptation to make an attempt at it himself, . . . he was without question the greatest of the precursors, and the world owes to him a great debt.”

You have also been greatly influenced by Lilienthal. By the time you hear the news that he has died trying to master flight, you have already become fascinated with the idea of manned flight. You decide that you must enter the arena with your own designs. Several of your closest friends are intrigued by your ideas; together, you form a company dedicated to the task of creating a successful airplane. Now you must begin your work to create an airplane and make it work.

Real-World Topics

- All great achievements involve persistent effort and occasionally great sacrifice.
- Making technological or scientific gains requires careful experimentation, observation, recordkeeping, and repetition.

Readings

The following list of readings and sources should be used to complete the activity.

Books:

- Bobby Mercer, *The Flying Machine Book: Build and Launch 35 Rockets, Gliders, Helicopters, Boomerangs, and More* (Chicago Review Press, 2012).

Archival Sources:

- [Wilbur Wright and Orville Wright papers, 1809-1979: 1904 Pamphlet](#)

Building Background

Those men and women who dared to achieve flight often took their lives into their own hands. The work was very difficult, and their efforts took great time and resources. In the movie clips linked below, you will see that very few of these many attempts were successful. Watch these movie clips to get a better sense of the difficulty many aviation pioneers experienced. Follow the link below and select the clips titled Early Aviation Failures.

- [Early Aviation Failures Movie Clips](#)

Activity: Testing an Aircraft

Open and read the [Wright brothers 1904 Pamphlet](#) describing their work testing their aircraft in December of the previous year. As you read, answer the following questions:

- What was the motivation for the Wrights to explain their efforts to document their work in this way?
- How many attempts at flight were made on December 17, 1903, by the Wrights?
- What were the wind conditions like on that day?
- In what way was the aircraft launched from the ground into the air?
- How fast was the Flyer able to travel through the air?
- What reasons do the Wrights give for why the first flights were much shorter than the final flight?
- Why did the Wrights decide to discontinue any further efforts at flight until the next season?

Now it is time to create and test your own fliers. Follow these steps:

Step One: Organize yourself into several groups. Your group will be your airplane company. Your company's goal is to research, create, and test a glider. Your first step will be to name your company. Select a name everyone in your company can agree on. Be playful with it, and come up with something descriptive and fun.

Step Two: Your next step is to research your airplane design. Your primary source for this research will be the book *The Flying Machine Book: Build and Launch 35 Rockets, Gliders, Helicopters, Boomerangs, and More* by Bobby Mercer. If the book is unavailable, your instructor will provide you a suitable substitute. Select a design that everyone in the company can agree on and for which you have the necessary resources. Each company will be selecting a different design, so you will want to let your teacher know which design you have selected.

Step Three: Build your aircraft following the instructions in the book. If any supplies are not available, make an effort to substitute with supplies that are available. Refrain from testing the aircraft until the testing phase.

Step Four: Once the aircraft is complete, you will want to bring your aircraft to the testing ground. This will be a location decided upon by your teacher, where space has been measured and marked for test flying.

Step Five: As you prepare to test your aircraft, you will want to assign each person in your group a specific role. One person should do the flying. One person should do the measuring. Another should note all the measurements. And others should make additional observations and notes throughout the process.

Step Six: You will make 10 attempts at flying your aircraft. After each attempt, discuss with your company what worked and what did not. Be sure to take notes of these discussions. Adjust your approach before each new attempt and then repeat the process.

Step Seven: The last step is to produce two reports.

- The first report is a complete version of the [flight table located at this link](#).
- The second is to draft a report on your experiments modeled on the Wright brothers' 1904 report linked above.

Reflect

Consider the following reflection prompts to use for a class discussion or short essay:

- What have your efforts at building and testing a glider taught you about the pioneering efforts of aviators?
- What new appreciation for this trial-and-error process have you gained by conducting your own efforts?
- In what way did the data collection efforts you used during the testing process help your efforts? How were these data most useful?
- Can you think of any other noble efforts where careful data collection during the trial-and-error process might prove useful?