1903: Powered Flight

The Society thanks you for the report on the success of the 1902 Glider. They are also following the progress of Samuel Langley's flying research. Langley had successfully flown a steam-powered aircraft three-quarters of a mile and won a $50,000 government grant to develop a passenger-carrying powered aircraft. Society members wondered whether the Wrights could beat him on their small budget, having spent less than $1,000 so far.

You have been on this project for almost 3 years, and the Society president asks you if you want to continue. You say yes. By now you have come to admire the Wrights and their genius and want to see them succeed. You know that powered flight is moving closer to becoming reality.

The reports from Dayton are that the brothers had been trying to find an engine with at least 8 horsepower and weighing less than 200 pounds. They couldn't find an engine like that, or a company willing to make one, so with the aid of their bicycle mechanic Charlie Taylor, they have been building their own engine. You travel to Dayton to check on progress, and when you arrive, they are already testing it. In just 6 weeks, having never made an engine before, they have produced one weighing 179 pounds that develops 12 horsepower! They never cease to amaze you.

Orville tells you that they are having difficulty with the design of the propellers. There are no reliable data on air propellers, only on water propellers, which would not apply to an aircraft. "Our only solution," he says, "is to design our own!" You wish them luck and they say they hope to see you at Kitty Hawk in the fall. You return to Cincinnati wondering whether they will get it right.

Wilbur in the damaged flyer after his unsuccessful trial on December 14, 1903. His hand still grips the wooden control lever.

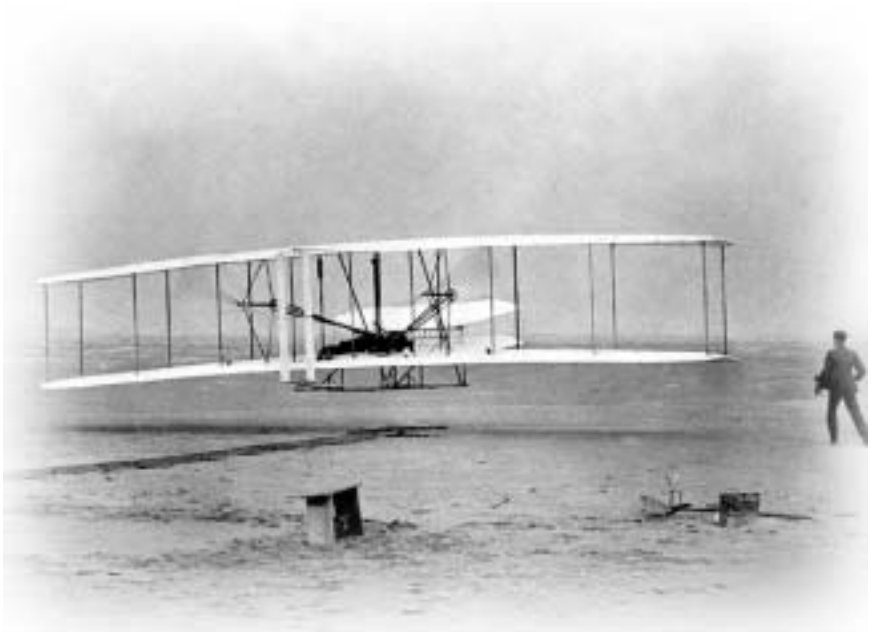
Further reports from Mr. Pierpont's cousin in Dayton indicate that the brothers intend to return to Kitty Hawk at the end of September, so once again, you head back to the Lifesaving Station. The Wrights arrive on September 25, 1903, and are glad to enlist your help in re-building their camp buildings and unpacking the crates holding the new craft. "This is the very first time we've seen it all together," comments Wilbur. "There just wasn't room in our shop." The aircraft looks like the 1902 model, but measures 40 feet from wing tip to wing tip and has twin rear rudders. On the lower wing opposite the pilot position is the motor, connected by chains to two long, thin propellers at the rear of the wing.

"We spent 5 months working on those propellers," said Wilbur. "Orville finally figured out that they needed to be shaped like rotating wings." Once the aircraft is together and testing begins, there are problems with the propeller shafts. Quick fixes don't work, so Orville travels back to Dayton to get new, stronger shafts.

He returns on December 11 and everything is ready to test on December 14. The brothers hoist their red flag, a signal for you and the Lifesaving crew to come help. The wind is not strong enough to launch from level ground, so the 60-foot launching track is set up on the side of Big Hill (the launching track consists of 15-foot sections of wooden rail, on which runs a launch cradle with bicycle hubs for wheels). The aircraft is pushed to the top of the track on its launch cradle. With the restraining rope in place, the motor is started and the propellers start to turn. Orville and Wilbur toss a coin to see who will be the first pilot. Wilbur wins and takes his position. He pulls the release rope, and the aircraft rolls on the cradle about 40 feet down the track, and starts to become airborne. Wilbur pulls up the nose a bit too sharply, and it stalls and settles back in the sand, breaking a few parts. It had been airborne just 3 seconds.

It takes some time to repair the damage, and on December 17, the red flag is hoisted again. It is very cold today, and the puddles on the way to the brother's camp are frozen over. The wind is blowing much harder than before. When the aircraft is set on the cradle, it is now Orville's turn to pilot. Orville has set up his box camera facing the end of the track and hands the squeeze camera bulb to John Daniels of your Lifesaving crew. Orville then gets into the craft and the rope is released. The wind is so strong that Wilbur runs alongside the craft to steady the wing as it takes off. Just as he lets go and the craft becomes airborne, Big John squeezes the camera bulb and snaps one of the most famous pictures ever taken. Orville flies for 12 seconds and lands a little over 120 feet from the end of the track. All of the people watching are cheering as you run to retrieve the airplane. You all shake hands and then go warm up by the stove before you carry the plane back up the track.

Three more flights are made, the longest being Wilbur's, which lasts 59 seconds and covers 852 feet. At long last, a man had flown a powered flying machine. As the brothers are getting ready for a fifth flight, a powerful gust of wind picks up the airplane and rolls it over and over. It is so badly damaged that more flights are out of the question. The Wrights thank everyone for their help, walk 4 miles up the beach to telegraph their father of their success, and pack up and return to Dayton to perfect their airplane.



The Wright Flyer takes off on the world's first successful airplane flight on December 17, 1903. Orville is at the controls, while Wilbur runs alongside.

Activity 16–Build a Model of the 1903 Flyer

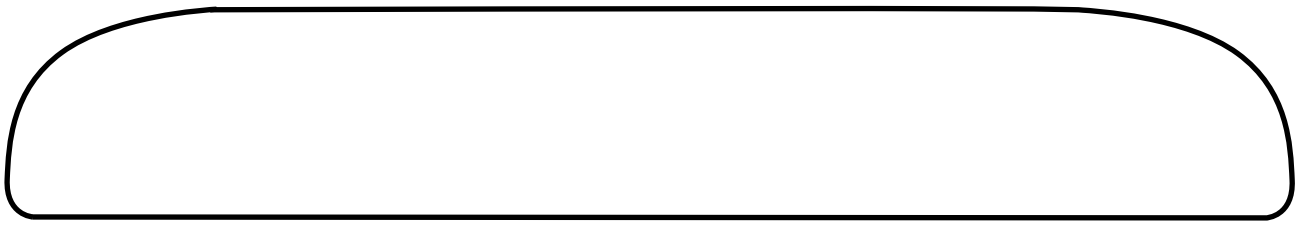
To make a model of the 1903 Flyer, follow the instructions beginning on page 63.

Activity 17–Balancing Forces

If you were either Orville or Wilbur Wright, and it came time to design a flying machine with an engine, where would you place the engine and where would you place the pilot? Do you think that the pilot should sit up or lie down on the wing? Don't forget that there had been numerous crashes in the brothers' gliders over the past 3 years. Give some serious thought to the reason or reasons for your decision.

The drawing below is a top view of the lower wing of the 1903 flying machine. Draw where you would put the pilot and the engine.

Back of wing



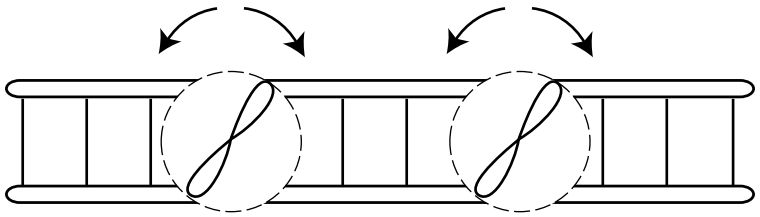
Front of wing

1. What are the advantages in the way you placed the engine and pilot?

2. What problems do you think might be created with your placement?

3. Does your pilot sit up or lie down? Why?

4. Circle the direction that each propeller needs to turn to create the least amount of torque (twisting) of the aircraft.



Activity 18–Center of Gravity

In constructing their 1903 Flyer, the Wright Brothers chose to place the engine on the wing next to the pilot. They felt that this would be safer for the pilot because the engine would not land on him if the flyer crashed. The problem that this created for them was one of balance. Neither Wilbur nor Orville weighed as much as the engine, and the wings needed to be level in order to have control of the plane. Try the following activity to see how to solve the problem:

Take a string and tie it around a 12-inch ruler in the exact middle. Now hook two paper clips together to represent the pilot and four paper clips together to represent the engine. Open up one of the end paper clips on each group as shown so that they can hang on the ruler (you can also cut the paper clip to size with a wire cutter). Hook the groups on either side of the center and then slide the paper clips along the ruler until the ruler hangs level.

When the ruler is level, the total weight of one set of paper clips times the distance from the center is equal to the total weight of the other set of paper clips times their distance from the center. Write down the inch readings for each group of clips.

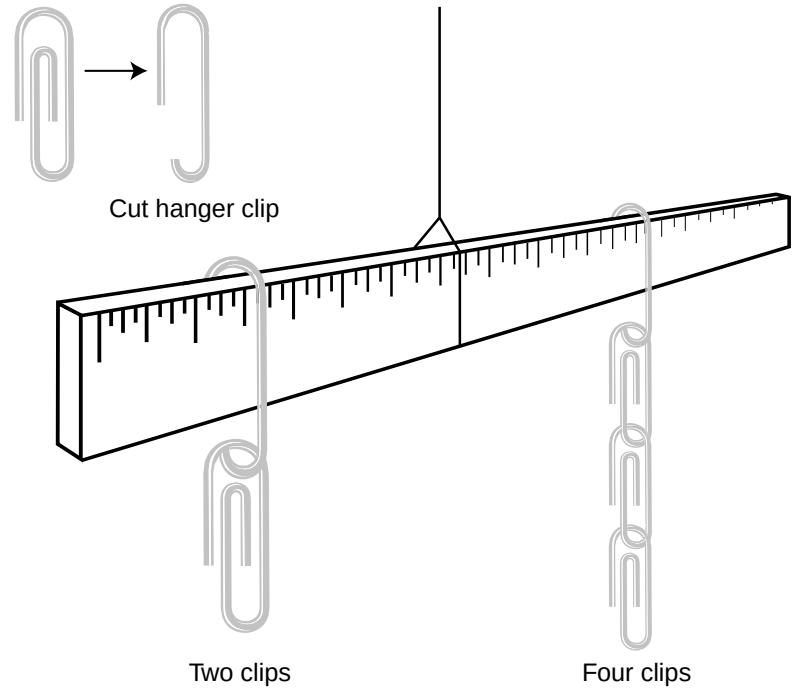
Two paper clips set at _____ inches from the center

Four paper clips set at _____ inches from the center

Since one group weighs twice as much as the other group, it should only be half as far from the center. Check the inch marks and see if this is true.

The Wright Brothers needed to stay near the center of the plane in order to control it, so rather than move farther out on the wing to balance the engine, they made the wings on the engine's side of the plane 4 inches longer than on the pilot's side. This caused extra lift force on that side to counteract the extra weight of the engine and keep the wings level!

You can simulate this by moving the four-paper-clip weight 1/4 inch farther away from the center so things are no longer balanced. Now, instead of moving the two-clip weight to rebalance, move the location of the string holding the ruler until everything is back in balance. Did you move the string toward the two-clip weight or the four-clip weight?



Activity 19–How Far Did They Fly?

Materials

Wooden ice cream sticks or craft sticks
Tape measure
Stopwatch or watch with a second hand

1. Have each person put his or her name on a wooden stick to use as a marker.
2. Go outside to the playground, a large field, or a baseball diamond and choose a starting point. This could also be done indoors in a gym or long hallway.
3. Each person takes a turn at placing their marker where they think 120 feet from the starting point would be, the distance of the Wright Brother's first flight. (These should all be placed along the same line from the starting point. You may want to lay a very long string down first to use as a guide, or you could use the foul line of a baseball field. Or each person could walk toward the same distant object.) Once placed, each person should stay by his or her marker so no one else steps on it.
4. When all the markers are in place, use the tape to measure off exactly 120 feet from the starting point and determine whose marker was the closest. Also, measure the distance each person was from the 120-foot mark and record these results in the table below. Once measured, be sure to remove all the sticks.
5. It took Orville 12 seconds to fly 120 feet, with Wilbur running alongside the airplane as it launched. See if you can run this fast. Time how many seconds it takes each person to run 120 feet and record the results.

Name	Distance from 120-foot mark	Time to run 120 feet
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

Questions

1. Whose stick was the closest to the actual 120-foot mark? Do you think this is a very far distance to fly?

2. Could the Wright Brothers have flown . . .

   A. From home plate to first base on a baseball field?

   B. From home plate to the outfield wall of the nearest professional baseball stadium?

   C. From one wing tip of a Boeing 747 jumbo jet to the other?

   D. From one goal line to the other goal line on a football field?

3. Make a graph showing the distance from each person's marker to the actual 120-foot mark of the first flight. Did the group make good estimations of the distance? Find the average distance from the 120-foot mark.

4. Make a graph showing how long it took each person to run 120 feet. Did the group run faster than the Wright Flyer flew? Find the average time for the group.

Math challenge

1. Your car can easily go 60 miles per hour and a jet airliner can cruise at 600 miles per hour. If the Wright Brothers flew 120 feet in 12 seconds on their first flight, calculate their speed in miles per hour.

   Hint: To do this you need to change feet to miles by dividing 120 feet by 5280, the number of feet in 1 mile. Then you need to change 12 seconds to minutes by dividing by 60, the number of seconds in 1 minute, and then change minutes to hours by dividing your last answer by 60, the number of minutes in 1 hour. Now divide the number of miles by the number of hours to find speed in miles per hour.