

Lesson 3:

What Is Up . . . With Aviation Science?

FLIGHT ROUTE

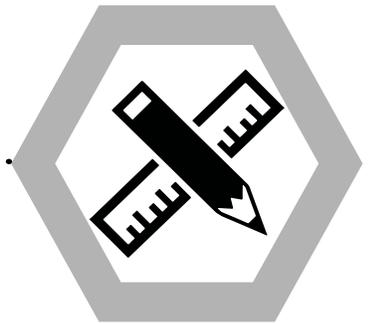
Where You'll Go Today

- In this lesson you will:
 - Learn about the physics of flight, and scientist Daniel Bernoulli's famous principle.
 - Learn how to use the Scientific Process to work through problems.
 - Conduct hands-on experiments to study how the force of lift works on an airplane.
 - Revisit the Adopt-A-Pilot **F.L.I.G.H.T.** Values examining the value of **HONESTY**.



MATERIALS

- 1 sheet copy paper - cut to approximately 5.5"x2" inches
- Scissors (from the classroom)
- Ruler (from the classroom)



THE ADOPT-A-PILOT VALUES

HONESTY



noun |
: the quality of being fair or truthful
: adherence to the facts



CRUISE - WITH THE SCIENTIFIC PROCESS

In-Class Experiment 1

Orville and Wilbur Wright flew the first powered airplane on December 17, 1903, but the science behind why an airplane flies was discovered centuries before. Today, you and your Pilot are going to study the science behind flight and the force of lift.

BERNOULLI'S PRINCIPLE:

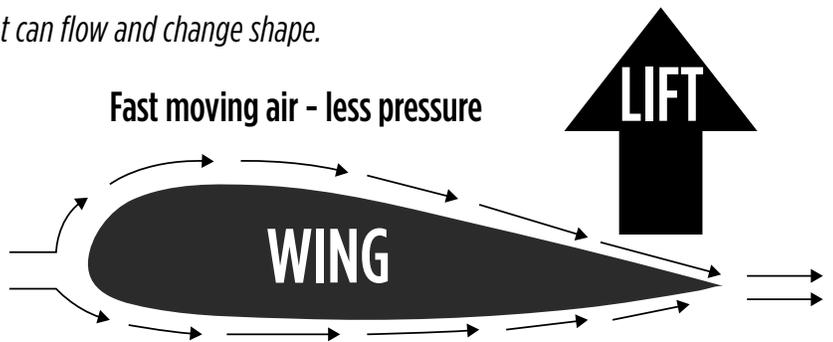
- Daniel Bernoulli (1700 – 1782) was a Swiss scientist and mathematician who spent his life studying the way that fluids move. The lessons learned from Bernoulli's work explains why boomerangs soar, baseballs curve, and airplanes fly!

- ***Bernoulli's Principle: slower moving fluids will exert more pressure than faster moving fluids.***

- *Fluids: a substance such as a liquid or gas that can flow and change shape.*

- *Exert: to put pressure on.*

- An airplane's wing is curved on the top and is relatively flat on the bottom. The air over the top of the wing moves faster than the air flowing under the wing.
- The slower moving air under the wing exerts more pressure than the faster moving air over the top of the wing creating the force of lift - Bernoulli's Principle at work!
- Airplane engines create thrust, which moves the airplane forward. As air rushes over the top of the wings, Bernoulli's Principle takes effect and the airplane flies!



THE SCIENTIFIC PROCESS

- *The Scientific Process: a step-by-step way to answer question or solve problems by conducting experiments, making observations and evaluating the results to reach a conclusion.*
- *Hypothesis: An educated guess based on current knowledge.*
 - There is no wrong answer!
- A simplified version of the Scientific Process can be found on the next page.

THE SCIENTIFIC PROCESS:

- **Step One:** Create a **HYPOTHESIS** about a question you have or a problem you want to solve.
- **Step Two:** Conduct an **EXPERIMENT** to test your **HYPOTHESIS**.
- **Step Three:** Record the **OBSERVATIONS** of your **EXPERIMENT**.
- **Step Four:** Based on your **OBSERVATIONS**, come to a **CONCLUSION**. Compare your **CONCLUSION** to your **HYPOTHESIS**. Did the results support your **HYPOTHESIS**?

LIFT AND THE SCIENTIFIC PROCESS - EXPERIMENT

Directions: Follow along as your Pilot demonstrates this experiment, recording your answers below.

• Step One: HYPOTHESIS

What will happen when you place a ping-pong ball directly in the air flow of a hair dryer?

The ping-pong ball will: _____

• Step Two: EXPERIMENT

1. Turn the hair dryer on cool with the maximum air flow and point the nozzle towards the ceiling.
2. Gently place the ping-pong ball in the air flow, about 1" above the nozzle, and release.
3. Slowly tilt the nozzle left and right about 30° and watch the ping-pong ball.

• Step Three: OBSERVATIONS

I observed the ping-pong ball: _____

• Step Four: CONCLUSION

The ping-pong ball did this because: _____

- Did the results support your **HYPOTHESIS? YES OR NO?** _____



CRUISE - UP OR DOWN WITH SCIENCE

In-Class Experiment 2

LIFT AND THE SCIENTIFIC PROCESS - EXPERIMENT

Directions: Complete each step of the experiment together, recording your answers below.

• **Step One: HYPOTHESIS**

If you hold a strip of paper to your bottom lip and blow over the top of it, what will happen?

The paper will: _____

• **Step Two: EXPERIMENT**

1. Cut a strip of copy paper so it measures approximately 5.5" x 2". Be careful not to bend or fold it.
2. Carefully hold the paper to the bottom lip of your mouth and steadily blow over the top of the paper strip.

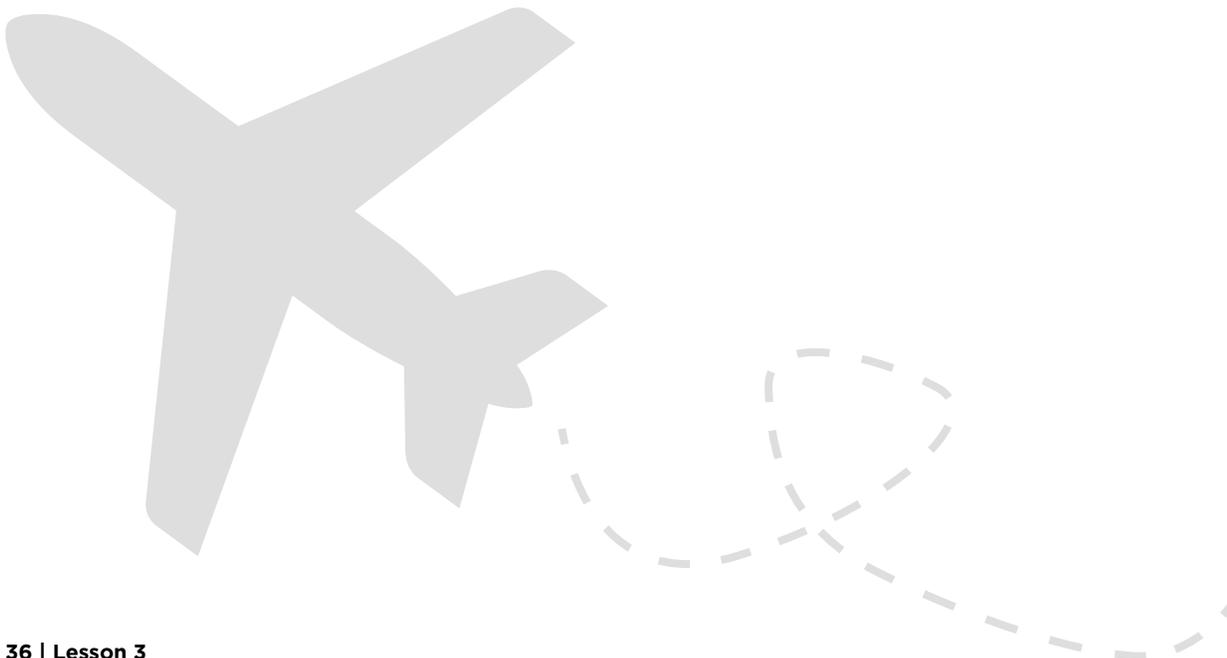
• **Step Three: OBSERVATIONS**

I observed the paper strip: _____

• **Step Four: CONCLUSION**

The paper strip did this because: _____

• Did the results support your **HYPOTHESIS? YES OR NO?** _____



LANDING.....

Wrapping Up the Lesson

- Congratulations! Today you learned:
 - First hand about the science of flight.
 - About Bernoulli's Principle and how lift makes an aircraft fly.
 - The steps of the Scientific Process, conducting experiments to determine if your hypothesis was supported by your results.



POST FLIGHT CHECKLIST.....

A Briefing For Your Pilot's Next Visit

- While your Pilot is away, complete the **3RD SOLO FLIGHT – UP, UP AND AWAY** activity. This activity reviews Bernoulli's Principle and the Scientific Process.
- Between now and the next time your Pilot visits, your teacher may have you complete **LESSON 3A: WHILE THE PILOT IS AWAY . . .FEEL THE FORCE!** This geography and math lesson has you look back at how far your Pilot has traveled in just a few weeks. Showing the world really is a big (and small) place
- During your Pilot's next visit, you will celebrate all you have learned during your Adopt-A-Pilot journey!



3RD SOLO FLIGHT - UP, UP AND AWAY

In-Class or At-Home Activity

PART ONE: THE ADOPT-A-PILOT F.L.I.G.H.T. VALUES

Write a couple of sentences explaining why being **HONEST** is always the best policy.

PART TWO: BERNOULLI'S PRINCIPLE AND THE SCIENTIFIC PROCESS

1. The four steps of the scientific process are:

Step One: _____

Step Two: _____

Step Three: _____

Step Four: _____

2. What is a hypothesis?

- a. A fact
- b. A myth
- c. An educated guess

3. Bernoulli's Principle says that : _____ moving fluids will exert _____ pressure than _____ moving fluids.

4. Bernoulli's Principle creates lift, which allows an airplane to fly.

- a. True
- b. False