Lesson 3:
What Is Up . . . With Aviation Science?

PRE-FLIGHT CHECK
Preparation for Your Classroom Visit

1. Topics You Will Cover:

- Review what the students covered while you were away.
- Explain the steps of the Scientific Process and reasons to use the Scientific Process.
- Introduce Daniel Bernoulli and Bernoulli's Principle.
- Use the Scientific Process to conduct two Bernoulli's Principle experiments.
- Re-visit the Adopt-A-Pilot **F.L.I.G.H.T.** Values examining the value of **HONESTY!**

During this lesson you will lead the students through the Scientific Process while they conduct hands on experiments related to Bernoulli's Principle. S.T.E.M (Science, Technology, Engineering, Math) is a big 'focus' for schools today. This lesson is a great way to share your enthusiasm for science while showing the kids a practical application!

2. Materials You Will Need:

Review

- Student Workbook
- Trip Sheet your class used for **LESSON 2A: WHILE THE PILOT IS AWAY. ..HAVE THE COURAGE TO SOAR!**
- Adopt-A-Pilot Classroom Map (in the Teacher's Program Supply Box)

Cruise – With the Scientific Process

- A ping pong ball (in the Teacher's Program Supply Box)
- A hair dryer (from home)
- *(Optional)*: A Toilet Paper Tube (from home)

Cruise – Down with Science

- Copy paper - One sheet for every two or three students (copy paper, etc.)
- Scissors and ruler - enough for each student or for a group to share (from the classroom)

TAKE-OFF

Lesson Guide for Your Classroom Visit

1. Reconnect and Review

- Review **LESSON 2: LOOK OUT BELOW … WORLD GEOGRAPHY!**
  - Invite a few students to share their **2ND SOLO FLIGHT – A JOURNEY THROUGH TIME** activity.
  - What time zone do they live in?
  - Who knows someone that lives more then five time zones away?
  - How many time zones do you cross to go from Phoenix, Arizona to Portland, Maine?
  - If it's 4:00 a.m. in Sacramento, California, what time is it in Tampa, Florida?
  - What does each letter of the Adopt-A-Pilot **F.L.I.G.H.T.** Values mean and how did they demonstrate **IMAGINATION** and **GRATITUDE** while you were away?
- If the class is participating, discuss what they discovered in **LESSON 2A: WHILE THE PILOT IS AWAY . . .HAVE THE COURAGE TO SOAR!**

  Note: Doing your own calculations before coming to class will help guide this activity.
  - Some fun facts to share:
    - Washington is home to the worlds largest building – Boeing's assembly plant.
    - Georgia is the number one producer of (the three "p's") peanuts, peaches and pecans.
    - Lake Superior is the largest freshwater lake in the world.
    - The Appalachian Trail is 2,180 miles long starting in Georgia and ending in Maine.
    - More facts can be found at: http://www.50states.com/facts/
  - Share any pictures or souvenirs.
  - Do the students have any questions before you get started?

2. Explain the Scientific Process

- *The Scientific Process: is a step-by-step way to answer questions or solve problems by conducing experiments, making observations and evaluating the results to reach a conclusion.*
- *Hypothesis: An educated guess based on current knowledge.*
  - There is no wrong answer! This is important for the student to understand.

Note: This is a simplified version of the Scientific Process:

STEPS OF 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**?

3. Introduce the Force of Lift

Note: It helps to draw air flow over a wing or have the students reference their Student Handbook.

- A simplified explanation of lift:
  - Lift is mainly created by Bernoulli's Principle.
  - *Bernoulli's Principle states: slower moving fluids will exert more pressure than faster moving fluids.*
  - Air is a fluid it can flow and change shape.
  - Air flowing over the top of an aircraft wing moves faster than the air moving below the wing.
  - The slower moving air below the wing has more pressure – which creates lift.
- Daniel Bernoulli discovered this principle in 1738. He is a great example of someone that used all of the **F.L.I.G.H.T.** Values.

4. IN-CLASS STUDENT EXPERIMENT 1: CRUISE - WITH THE SCIENTIFIC PROCESS

Note: It's great to get the students involved. One can hold the hair dryer, another the ping-pong ball.

- Explain this Bernoulli's Principle experiment.
- Will the ping-pong ball fly? Will it fall to the ground? Have the students share their thoughts and then record their hypothesis.
- Conduct the experiment:
  1. Turn the hair dryer on cool and maximum air flow, 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° to show how the ping-pong ball keeps flying.
  4. (*Optional*): Place an empty toilet paper tube above the ping-pong ball and see how this effects the behavior. Or do the experiment with a leaf blower and a beach ball for added WOW factor.
- Have the students record their observations.
- Guide the students as they come to a conclusion. Why did this happen?

- Did the results support the students' hypothesis? Remind them that it's not important whether their hypothesis was correct. What is important is what they learned from the experiment.
- *Explanation:* The ping-pong ball 'flies' because the air flow directly above the nozzle is faster (exerting less pressure) than the static air (exerting higher pressure) outside the nozzle's air flow.

5. IN-CLASS STUDENT EXPERIMENT 2 : CRUISE - DOWN WITH SCIENCE

Note: Each student will have the opportunity to do this experiment.

- Explain this Bernoulli's Principle experiment.
- The students know if you blow under the strip of paper it will 'fly'(demonstrate for emphasis). But what happens if you blow over the top? Will the strip of paper still fly? Have the students share their thoughts and then record their hypothesis.
- Conduct the experiment:
    1. Have the students cut a strip of copy paper approximatley 5.5"x2" inches, being careful not to bend or fold it.
    2. Have the students gently hold the strip of paper below their lower lip.
    3. Have the students blow over the top of the strip of paper with a slow and steady breath.

    Note: Some students may struggle. Make sure the paper is very close to their lower lip and that they blow steadily.
- Have the students record their observations.
- Guide the students as they reach a conclusion. Why did this happen?
    - Did the results support the students' hypothesis? Remind them that it's not important whether their hypothesis was correct. What's important is what they learned from the experiment.
    - *Explanation*: When you blow over the top of the paper you increase the speed of the air flow (exerting less pressure) than the static air (exerting higher pressure) underneath.

6. The Adopt-A-Pilot F.L.I.G.H.T. Values

- Lesson focus - **HONESTY**: *Noun| the quality of being fair or truthful; adherence to the facts*.
- **HONESTY** is being accountable for your actions.
- Have a discussion with the students about **HONESTY**. Is it always easy to be honest? Why are people dishonest?
- What does **HONESTY** mean to them? Is omitting a detail dishonest?
    - The Wright Brothers' were honest in admitting when their first attempts at flight failed, allowing them to learn from their mistakes and finally succeed.
    - Ask the students if they believe the saying, 'honesty is the best policy'?

LANDING

Wrapping Up Your Classroom Visit

- Introduce the **AT HOME ACTIVITY: 3RD SOLO FLIGHT – UP, UP AND AWAY.**
- What did they learn today? What else would they like to know about aviation science?
- What have they liked about Adopt-A-Pilot so far?
- Emphasize the importance of **HONESTY** and all the **F.L.I.G.H.T.** Values. Which values did the students use today?
- Give them a glimpse of the next time you will be in class - the conclusion of Adopt-A-Pilot.
- Discuss where you will be flying between now and your next visit.
- If they are participating in the **'While The Pilot Is Away'** activity do they have questions?
- Thank the students and teacher; let them know you appreciate their **HONESTY!**

POST FLIGHT CHECKLIST

A Touch-and-Go For Your Next Visit

- If the class is participating, discuss **LESSON 3A: WHILE THE PILOT IS AWAY . . .FEEL THE FORCE!** Make sure they have a copy of your trip sheet and answer any questions.
- Next visit, you will celebrate all the class has accomplished during the Adopt-A-Pilot program.
- Review the best way to approach this lesson.
  - Are they going to participate in the Adopt-A-Pilot Tie Contest?
  - Are you going to play one of the games discussed in **LESSON 4: DESTINATION. . . ADOPT-A-PILOT COMPLETION DAY!** If so, how are you going to organize the class?
  - Are you going to bring a 'treat' (cupcakes, pizza, peanuts etc.) for the students? Are there any allergies you need to know about? Do you need to bring plates, napkins, etc?
- Student completion certificates are provided in the Teacher's Program Supply Box. There is a space for you and the teacher to sign. It is a good idea to sign them and to check the spelling of the students names now.
- Be prepared to connect with the students between visits:
  - Send emails or postcards.
  - Take photos, videos, or collect souvenirs to share.
  - Arrange a time to call or Facetime®.