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| **Title**  | First in Flight: The Sciences That Make Flight Possible |
| **Introduction**  | North Carolina has a rich history in flight. In 1873, the first documented airplane was built outside of Murfreesboro by Henry Gatling. The state is credited for being “First in Flight” as Wilbur and Orville Wright flew their powered glider successfully at the beaches of Kill Devil Hills on December 17, 1903. A few years later in 1907, Levi Paul was the first person to get a helicopter to lift off the ground in Davis. Tiny Broadwick of Oxford was the first woman to parachute from a plane in 1913.This strong flight background sets the state up beautifully for further success in aviation. To date, there are over 180 aerospace industry companies in North Carolina, and the number is only growing. Aviation alone brings in about $11.8 billion to the state each year. With numbers like this that continue to grow, North Carolina must think about its future in the flight game.Throughout the series of lessons, students will learn about the sciences that make flight possible. They will explore all aspects of flight, such as engineering, physics, chemistry, weather, biology, and cartography. They will engage in various hands-on activities to familiarize themselves with these concepts, and will participate in a group final project to pull all the information together. The final project will consist of students designing and marketing an aircraft for an aerospace company to send to space with NASA. Students will go through the engineering design process and test their designs, and then have to use marketing strategies to make their aircraft seem most appealing to companies. Ideally, students will present in a board room to aerospace engineers. |
| **Real Science Application**  | With a growing aerospace industry, North Carolina needs to think how it can prepare its youth to take over the aerospace science jobs the state has to offer now and in the future. It is imperative to teach students that flight is about more than just physics. This program offers a multi-faceted view on the sciences behind flight, and students will expand their horizons in their understanding of aerospace and aeronautics. |

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| **Curriculum Alignment**  | **NC Essential Standards**

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| Content Area | Grade Level | NC SCS |
| Science | 3rd  | 3.P.1.1 - Infer changes in speed or direction resulting from forces acting on an object. |
|   |   | 3.P.1.3 - Explain the effects of Earth’s gravity on the motion of any object on or near the Earth. |
|  |  | 3.E.1.1 - Recognize that Earth is part of a system called the solar system that includes the sun (a star), planets, and many moons and the Earth is the third planet from the sun in our solar system. |
| Social Studies  | 3rd | 3.G.1.4 - Explain how the movement of goods, people, and ideas impact the community. |
|   |   |  3.E.1.2 - Explain how locations of regions and natural resources influence economic development. |
|   |   |  3.E.2.2 - Give examples of entrepreneurship in various regions of our state. |

**Common Core Standards**

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| Content Standard |
|  CCSS.ELA-Literacy.RI.3.1: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. |
|  CCSS.ELA-Literacy.RI.3.2: Determine the main idea of a text; recount the key details and explain how they support the main idea. |
|  CCSS.ELA-Literacy.RI.3.7: Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). |
|  CCSS.ELA-Literacy.SL.3.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly. |
|  CCSS.ELA-Literacy.SL.3.4: Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. |
|  CCSS.ELA-Literacy.SL.3.6: Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (See grade 3 Language standards 1 and 3 [here](http://www.corestandards.org/ELA-Literacy/L/3/) for specific expectations.) |
|  CCSS.ELA-Literacy.L.3.1: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. |

**Next Generation Science Standards**

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| Content Standard |
| 3-PS2-1: Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. |
| 3-PS2-2: Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion. |
| 3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. |
| 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |

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| **Learning Outcomes**  | Students will understand that/how…* the aerospace industry economically benefits the state of North Carolina
* to use the engineering design process
* to market and “sell” a product to the aerospace industry
* the full scope of science that makes flight a reality

Students will keep considering…* What is the relationship between flight and the solar system?
* What is the importance of space flight for our future?
* How does marketing affect the economy?
* *How can North Carolina’s history with flight tell us more about our state’s future in the aerospace industry? - this should be discussed during the social studies portion of the lesson, as found in the social studies supplement*
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| **Time Required and Location**  | * Building Background Activity: 60 minutes (Classroom)
* Activity 1: 60 minutes (Classroom & Hallway)
* Activity 2: 60 minutes (Classroom & Outdoor Space)
* Activity 3: 75 minutes (Classroom)
* Activity 4: 65 minutes (Classroom & Outdoor Space or Gym)
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| **Materials Needed**  | All materials needed are listed with each lesson plan below. |
| **Safety**  | When outside for the Diet Coke and Mentos demonstration, make sure students are at a safe distance from the launch site. |
| **Student Prior Knowledge**  | Students should have background knowledge on forces and understand how pushes and pulls change the motion of an object.Students should have background knowledge about the solar system to prepare them for their final project. |
| **Teacher Preparations**  | * Building Background Activity
	+ Collect materials listed in lesson plan
	+ Create glider to show as an example
* Activity 1
	+ Gather paper and templates for paper airplane creation
	+ Create a couple paper aircraft examples
* Activity 2
	+ Collect materials listed in lesson plan
		- For teacher demonstration with Diet Coke and Mentos - acquire one 2-Liter bottle of Diet Coke and one packet of Mentos (mint)
		- For student activity with baking soda and vinegar - pre-fill water bottles each with four ounces of vinegar; pre-fill balloons with two tablespoons of baking soda
* Activity 3
	+ Print maps for student use
	+ Make copies of weather condition observation sheet
* Activity 4
	+ Gather materials listed in lesson plan
	+ Make copies of Astronaut Boot Camp Activity Log
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| **Activities**  | **Building Background Activity Overview**: What forces keep aircraft airborne? Learn about the four primary forces of flight and how aircraft are modeled to take advantage of those forces.Objectives:* Students will demonstrate how lift, weight, thrust, and drag help make an aircraft fly.
* Students will explain the effects of gravity and how forces need to be balanced so an aircraft can fly.

Vocabulary: flight, lift, weight, thrust, drag, gravity, forceMaterials (PER STUDENT):* 1 straw (NOT a bendy straw)
* 1 index card (any size)
* Masking tape (share at table)
* Transparent tape (share at table)
* Scissors

Online Resources: <http://www.brainpop.com/technology/transportation/flight/> Procedure:1. Read objectives with students. Have students turn and talk with their partners to state the objectives in their own words. *5 minutes*
2. Show students BrainPOP! video about flight (linked above). Stop the video at the four forces of flight and have students rearticulate the definitions to their partners. *10 minutes*
3. Review vocabulary words (listed above) -- refer to word wall cards. *10 minutes*
4. Explain student activity -- creating Straw Gliders. Show students a pre-constructed Straw Glider. Then, let students create their own. *15 minutes*
	1. Students will cut the index card in three vertical pieces.
	2. Roll one piece into a small loop and tape it shut. Then, tape the other two pieces together to make a large loop and tape it shut.
	3. Place the straw inside the two loops. Tape the straw inside the loops.
5. Let students fly their Straw Gliders thinking about the four forces of flight. What if we add a paperclip to the back loop? What would happen? Let students experiment. *5 minutes*
6. Bring students back together. Debrief with them: How did you see the four forces of flight work in your demonstration? Brainstorm a list of things students noticed about their aircraft. *10 minutes*
7. Review objectives with students. *5 minutes*
8. Exit Ticket: What are the four forces of flight? How do they work together to keep aircraft in the air?

Extensions:* Have students make some alterations to their Straw Gliders. How can they make their glider soar longer? (This is a great lead-in activity for the Activity 1: Paper Airplane Prototyping)

**Activity 1 Overview - Paper Airplane Prototyping**: Spend time being an innovative engineer and create a prototype of a paper aircraft! Explore some premade models and work through all the ways you can make your paper aircraft experience long air-time.Objectives:* Students will create a paper airplane design using my knowledge of flight.
* Students will explain how lift, weight, thrust, and drag impact the flight of my paper airplane.

Vocabulary: lift, weight, thrust, drag, force, gravityMaterials (AT EACH TABLE):* Paper (computer paper, construction paper, cardstock, index cards)
* Instruction cards/design templates for various paper aircraft
* Scissors
* Masking tape
* Pencils

Online Resources: <http://www.funpaperairplanes.com/>Procedure:1. Read objectives with students. Have students turn and talk with their partners to state the objectives in their own words. *5 minutes*
2. Review vocabulary words (listed above) -- refer to word wall cards. *10 minutes*
3. Explain student activity. *30 minutes*
	1. Show students some pre-made models of various paper aircraft. Ask students what they think about the models. *10 minutes*
	2. Have students work with a partner. They will create a paper airplane and another type of paper aircraft. They will spend 20 minutes working on this, and then they will share with the group. *20 minutes*
4. Each pair will share one of their aircraft. Engage students in a discussion about which aircraft fly the furthest/longest and test the aircraft. Why is this? Discuss the lift, weight, thrust, and drag of the aircraft. *15 minutes*

Extensions:* Challenge these students to think outside the box -- can they create a paper aircraft that is NOT a paper airplane? They can fly their aircraft multiple times, record how far it goes each time, and create a graph/find the average of how far the aircraft goes.

**Activity 2 Overview - Rocket Power**: Did you know that rockets don’t use the same kind of fuel we put in cars and buses? Learn about how rocket fuel uses chemical reactions to make lift-off happen!Objectives:* Students will explain the effects of Earth’s gravity on objects (rockets).
* Students will infer the changes in direction of an object (a rocket) when forces are applied to it.
* Students will understand how rocket fuel provides thrust for a rocket.

Vocabulary: lift, thrust, force, gravity, weight, dragMaterials (PER PAIR OF STUDENTS):* 1 empty water bottle
* 2 tablespoons baking soda
* 4 ounces vinegar
* 1 balloon
* Science journals - each student should have one of these
* Pencils

Online Resources: <http://www.stevespanglerscience.com/lab/experiments/original-mentos-diet-coke-geyser> Procedure:1. Read objectives with students. Have students turn and talk with their partners to state the objectives in their own words. *5 minutes*
2. Review vocabulary words (listed above) -- refer to word wall cards. *5 minutes*
3. Explain that you will take students outside to do a little demonstration. You, the teacher, will need a 2-liter bottle of Diet Coke and a pack of Mentos. Remind students of classroom safety procedures before going outside. *10 minutes*
4. With students outside in a circle, explain how rocket fuel works. It isn’t like the gas we put in cars and buses that get us to school -- instead, it can be a solid that has a chemical reaction to oxygen, the air we breathe. This chemical reaction causes THRUST for the rocket to get out of our atmosphere into outer space, so it has to be pretty powerful! Today we will demonstrate and experiment with how thrust works to get a rocket up into space! *5 minutes*
5. Do Diet Coke and Mentos demonstration (students should not be anywhere near the bottle!). *2 minutes*
6. Take students back to classroom. Have them write and draw what they saw happen in the demonstration in their science journals. Then, have students share at their tables when they finish. *5 minutes*
7. Explain now that students will have the opportunity to see how thrust works with a chemical reaction. Materials (listed above) should be at their tables, ready for them to use. Go over safety again with students. Talk students step by step through what they need to do with the materials at their tables: *20 minutes*
	1. Balloon = baking soda (NHCO3), bottle = vinegar (C2H4O2) -- make a prediction as to what you think will happen when you combine these two things together. Write it in your journal.
	2. Partner A should hold the water bottle of vinegar while Partner B carefully places the opening of the balloon on top of the mouth of the water bottle, pouring the baking soda into the bottle. Write and draw your observations in your science journals.
8. Bring students back to carpet in a circle with their journals. Engage in an open discussion about what they observed during the demonstration and their experiment with their partner. *5 minutes*
9. Review objectives again with students to see how they feel about the lesson and demonstrations. *2 minutes*
10. Exit Ticket: How does thrust work to get a rocket into the solar system?

Extensions:* Challenge students to think of other ways that thrust can be created. Have them brainstorm with a partner or at home about other ways they could try to get a rocket to launch.

**Activity 3 Overview - Tracking with Mapping**: The weather we experience every day greatly impacts rockets and their launches. Using weather maps, the International Space Station feed, and a tracking map, you will need to determine when you will be able to launch your rocket to dock on the ISS!**!**Objectives:* Students will read a map to determine if the weather will be good for a rocket launch.
* Students will compare and analyze weather data and tracking information to figure out when will be a good day to launch a rocket.

Vocabulary: weather, force, wind, rocket, launch, International Space Station, gravityMaterials (AT EACH TABLE):* One Southeast Current Surface Map - weather.com
* One Southeast Doppler Radar Map (2100 miles) - weather.com
* One 7-Day Forecast Map - NOAA.com
* Science journals/weather observation form
* Glue sticks
* Pencils

Online Resources: <http://www.brainpop.com/technology/transportation/internationalspacestation/> - intro<http://www.nasa.gov/multimedia/nasatv/iss_ustream.html#.U8bVymTXj18> - live stream<http://www.isstracker.com/> - ISS tracking<http://spotthestation.nasa.gov/> - specific location finder for ISSProcedure:1. Read objectives with students. Have students turn and talk with their partners to state the objectives in their own words. *5 minutes*
2. Review vocabulary words (listed above) -- refer to word wall cards. *5 minutes*
3. Show students BrainPOP! International Space Station video. Explain that the ISS travels around the Earth EVERY DAY! Follow this discussion with the live stream website. Ask: What do you notice about the people on the ISS? That’s right, they’re FLOATING! That’s because they’re too far away from Earth’s gravitational pull to be pulled back to the ground! *10 minutes*
4. Explain today’s task: we need to send a rocket to dock with the ISS. How are we going to do this?! There are two important factors that we need to consider before launching our rocket: the weather and the location of the ISS. How are we going to find the ISS if we can’t see it out in space!? Well, we use technology of course! (Show ISS tracking site) *5 minutes*Now, before we can choose our launch date, we need to track the ISS and check our weather forecasts. Let’s go outside and check the weather we’re experiencing here in North Carolina now! Before we go, be sure to glue your weather observation sheet in your journal. (Take students outside with their science journals and observe the weather - they can write or draw what they see) *10 minutes*
5. Come back to class. Discuss what they observed. *5 minutes*
6. Direct student attention to map examples on the board: We will look at three different types of maps. The Current Surface Map shows us what the weather is like where we are. Blue lines with triangles show cold fronts. Red lines with half-circles show warm fronts. H means high pressure, and L means low pressure, and that has to do with the wind in the area. These little white lines on the map are called isobars, and they tell us how FAST wind blows. The closer these white lines, the faster the wind is going. Turn and talk: Do you think it’d be a good or bad idea to launch a rocket on a windy day? Why/why not? (Let students share) The Doppler Radar Map shows us the precipitation that is occurring in our area. Ask: Do you know what precipitation means? Precipitation is water that falls to the ground from the sky, like rain, sleet, snow, or hail. Wherever you see green, there’s rain -- if it’s yellow or red, the rain is really hard and there could be a storm. The last map we’ll use is a seven-day forecast map that gives us a brief description of the weather we’ll experience for the whole week.The other thing we need to think about is the location of the ISS. We’ll use this tracking website to find out where the ISS is on its travel around the planet! (Put ISS tracking website, listed above, projected on the screen -- if possible, have students use a tablet or a laptop to watch the ISS travel at their table while they work)Our task is to figure out when the weather will line up with the ISS location above North Carolina. You will work with your partners at your table to read the maps and track the ISS. Then, you’ll share with the class when you’ll launch your rocket! *20 minutes*
7. Bring students together on carpet with their maps and journals. Have them share their information and justify why they chose their date/time. *10 minutes*
8. Review objectives with students. *2 minutes*
9. Exit Ticket: How do maps relate to flight?

Extensions:* Introduce students to other kinds of weather maps. Engage in a discussion comparing the maps and their uses. Then, have students create their own kinds of weather maps with their own keys/legends and share with the class.

**Activity 4 Overview - Astronaut Boot Camp**: With commercial space flight on our horizon, what kinds of training should we do to prepare ourselves to go into outer space? These activities, from NASA’s Train Like an Astronaut Program, will help you prepare for lift off!Objectives:* Students will rotate to stations to experience astronaut training.
* Students will justify whether or not I am fit to be an astronaut.

Materials (BASED ON STATIONS - stations should accommodate 4 students):* Station 1: Jump for the Moon
	+ 2 jump ropes
	+ Stopwatch
* Station 2: Agility Astro-Course
	+ Cones/markers - something to put on ground for students to run around
	+ Stopwatch
* Station 3: Crew Assembly
	+ 4 pairs of gardening gloves
	+ 2-25 piece puzzles (labeled backs of outside pieces = A, backs of inside pieces = B -- suggest using different colors to label for different puzzles)
	+ Stopwatch
* Station 4: Mission: Control!
	+ 2 tennis balls
	+ 1 dodgeball
* Station 5: Speed of Light
	+ 2 Rulers
	+ Stopwatch
* PER STUDENT: Astronaut Boot Camp Activity Log, pencil, clipboard

Online Resources:<http://www.nasa.gov/audience/foreducators/trainlikeanastronaut/home/#.VOUd7xbV7m6>Procedure:1. Review objectives with students. Have students turn and talk with their partners to state the objectives in their own words. *5 minutes*
2. Explain to students that today, they will participate in Astronaut Boot Camp! Commercial space flight is becoming more and more of a possibility for us in our lifetimes, so many people will need to learn how to survive in outer space! Students will rotate to stations and experience some training that astronauts do before going to space. They will have an activity log to track how they feel about their boot camp training. They will need to fill this out after each station. *10 minutes*
3. Put students into groups of four (this may already be done depending on how your classroom is set up) -- this allows for students to have a partner while also working with a larger group. It may be a good idea to set up stations beforehand if possible, and to also meet outside or in a large, open area for students to move. Students will spend 8 minutes at each station. *40 minutes*
4. When students have completed their rotations and activity logs, bring students to the carpet to debrief. Ask students how they felt about the training activities and whether or not they feel like they’re fit to be an astronaut! *10 minutes*
5. Exit Ticket: Why is it so important for astronauts to be physically prepared to go into outer space?

Extensions:* Students can spend more time observing the ISS (link: <http://www.nasa.gov/multimedia/nasatv/iss_ustream.html#.U8bVymTXj18>) and then write a narrative about their imagined time in space from the point of view of an astronaut.
* The commercial space flight training program has not yet been completed. Based on their experience, students may want to write what THEY think people should do to prepare themselves for commercial space flight.
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| **Assessment**  | **FORMATIVE ASSESSMENT****Building Background Activity**: Student discussion and anecdotal notes.* Exit Ticket: What are the four forces of flight? How do they work together to keep aircraft in the air?

**Activity 1**: Anecdotal evidence - observe students creating and interacting with their peers to understand how they’re thinking about their airplane prototypes.* Exit Ticket: Science journal records of time and distance of flights, as well as reflections on activity.

**Activity 2**: Use Mentos & Diet Coke observation sheet to determine student understanding. Also can use anecdotal evidence.* Exit Ticket: In your own words, explain the force of flight that allows the rocket to stay in the air. How does it work?

**Activity 3**: Use science journals and anecdotal evidence to determine student understanding.* Exit Ticket: How do maps relate to flight?

**Activity 4**: Astronaut Boot Camp activity log documenting students perceptions of how they felt after each activity.* Exit Ticket: Why is it so important for astronauts to be physically prepared to go into outer space?

Throughout all activities, the formative assessment of “Turn and Talks” (also known as Accountable Talk) will be present. During Turn and Talk time, students turn and engage with a partner in discourse about the topic at hand. In my experience, I have found it to be beneficial to pre-pair students in assigned seats on the carpet in order to save time in transitions. More information on how to partner students can be found in the references section of this document.**SUMMATIVE ASSESSMENT**At the end of the three activities, students will participate in a Bridge activity. This is when the teacher elicits vocabulary words from the students, writes them on chart paper, and, with the students, translates the words from English to Spanish. A contrastive analysis is then done with the words (you may want to do this the following day depending on time), and this information is displayed in the classroom for students to continue to reference. Find examples of the contrastive analysis concept within the unit vocabulary (listed on the next page), and then come up with more examples with students to display. I suggest focusing the contrastive analysis on Morphology, using the following words as keywords to demonstrate your linguistic point: fuselage/*el fuselaje*, force/*la fuerza*, aileron/*el aleron* (these words are all cognates -- once you have pointed this out, ask students to share examples of words they know that are cognates). For more information about the Bridge, see the references section.Students will engage in a group project with two components. First, students will work in a group to design an aircraft. Then, students will work in a group to come up with a marketing strategy to get aerospace companies to buy their product. Below is the GRASPS culminating task checklist from the Understanding By Design unit framework.Task checklist:**G** = Your goal is to design and market an aerospace product.**R** = Advertiser (Spanish)/Engineer (English)**A** = Aeronautics Industry**S** = There are 180 aerospace companies in North Carolina. They are looking for new designs for aircraft to send to space.**P** = Your product is a blueprint design and model of the aircraft itself.**S** = 3.E.1-2 (social studies/economy - see social studies supplement), 3.E.1 (science), W.3.1, rubric (see attachment)Task Description:Blueprint/Model - There are 180 aerospace companies in the state of North Carolina. They are looking for new designs for aircraft to send to space. Your job is to be an engineer and create a blueprint and model of an aircraft that the companies can send to space. You will then be an advertiser to market your new design/model to a group of aerospace engineers. |

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| **Critical Vocabulary**  | **English word** (*Spanish word*): definition* TPR hand motion description

**force** (*la fuerza*): a push or a pull* push both hands out (like you’re pushing someone), pull hands back in (like you’re pulling out a drawer from a dresser)

**lift** (*la sustentacion*): an upward pull* push both hands up

**weight** (*el peso*): the downward force that Earth’s gravity exerts on all objects; works against the aircraft’s ability to fly* point downward toward ground

**thrust** (*la traccion*): any force that moves a plane forward* punch outwards away from you

**drag** (*la resistencia aerodimamica*): the resistance of air against anything that moves through it; works against the aircraft’s ability to fly* pretend to walk in a really windy storm -- move slowly, show facial expressions like it’s hard for you to move through the air (kind of like a slow motion walk)

**aileron** (*el aleron*): found on the airfoils (wings) of a plane; controls aircraft movement (roll axis)* hold one arm out in front of you; attach and move your opposite hand up and down in the middle of your arm

**elevator** (*el ascensor*): found on the back of a plane; controls aircraft movement (pitch axis)* move body up and down, bending knees to alternate height

**rudder** (*el timon*): found on the back of a plane; controls aircraft movement (yaw axis)* put hands together and move them from side to side in front of you

**yaw** (*el bandazo*): the rotation around the vertical axis (controlled by the rudder)* hold arms out like you’re a plane and your arms are wings; twist your body around from side to side

**roll** (*la inclinacion*): the rotation around the front-to-back axis (controlled by ailerons)* hold arms out like you’re a plane and your arms are wings; alternate right “wing” and left “wing” in the air

**pitch** (*el angulo de ataque*): the rotation around the side-to-side axis (controlled by elevators)* hold arms out like you’re a plane and your arms are wings; lean forward and backward

**airfoil** (*el plano aerodinamico*): the wing of the aircraft* hold one arm out from your body to simulate the wing of a plane and use the opposite hand to point to your arm

**fuselage** (*el fuselaje*): the body of an aircraft* use both hands to motion to the torso area of your body

**fin** (*la aleta*): vertical stabilizer on an aircraft* bring both hands together (like a prayer position) in front of your face to act as a stabilizer

**gravity** (*la gravidad*): the force that pulls objects together* start with hands open and arms extended away from you, then pull hands together and clasp hands
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| **Community Engagement**  | * Field trip to Morehead Planetarium
* Bring in Star Lab from Museum of Life and Science
* Field trip to aerospace company to present aircraft model
* *CHAOS* (Chapel Hill Astronomical and Observational Society) community group come do a skywatching event with students/families
* NC Science Festival paired aerospace company contacts
* NC Science Festival elementary school Folt Science Night (week of the festival) - this will take place in the spring
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| **Extension Activities**  | Extensions are included for each activity in the individual lesson plans. |

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| **Modifications**  | When grouping students, make sure native English-speaking students are paired with native Spanish-speaking students. Also take into account student achievement level and personalities for successful group dynamics. |
| **Alternative Assessments**  | Here are some suggestions for assessment modifications within the activities:* Give students (especially LEP and ELL students) a word bank with vocabulary words to help them with writing exit tickets.
* Provide students sentence frames to complete exit tickets or any other writing they need to do.
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| **References** | * **How to Partner Students** - When I partner students, they have the same partner at their desks as they do when they sit on the carpet during instruction. In my classroom, half the students are English language learners and the other half are Spanish language learners. In pairing students, I try to put an English learner with a Spanish learner, and I focus on student strengths and areas of improvement for partnerships. For example, a student who is strong in verbal communication skills might be paired with a student who is not as strong verbally, but who is a strong written communicator, so that the students can help one another. Considering ability pairing, I find it best to pair as follows: high-high, high-medium, medium-medium, medium-low. In order to partner students, it’s imperative that they know how to communicate with one another in a respectful manner, which should be established at the beginning of the year.
* **Benefits of Accountable Student Talk**:
	+ <http://www.ascd.org/publications/books/108035/chapters/Why-Talk-Is-Important-in-Classrooms.aspx>
	+ <http://www.brown.edu/about/administration/sheridan-center/teaching-learning/effective-classroom-practices/think-pair-share>
* **What is a Word Wall?** - On my word walls, students have access to vocabulary words for our unit that are accompanied by non-linguistic representation (there are pictures on the cards, and students learn [TPR](http://www.tprsource.com/asher.htm) to go with each word as well). Students also use word walls to find our unit’s essential questions, and there is always an interactive piece to the wall so students can engage with one another in their learning. Below is an early stages example for this unit’s word wall from my classroom.

IMG_8120.JPG* **Biliteracy References - The Bridge**: <http://www.massmabe.org/upload/Urow%20Handouts%20Southern%20New%20England%20Regional%20Conference%20for%20Dual%20Language%20Programs%202013.pdf>
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| **Supplemental Information**  | See attached:* K-5 book list -- this list can be used for teachers to select books to read aloud to their students in the classroom. (<https://docs.google.com/spreadsheets/d/19cM9fxIbd94s_MnzGTTfgNdEQD2dY5L49kMF7uLrhyQ/edit?usp=drive_web>)
* Activity 3 Supplement -- Weather Observation Sheet (<https://docs.google.com/document/d/13c0mEyoljhETmMhHDYxeVIaSP6sS0OtKv2hCUtuZXT8/edit>)
* Activity 4 Supplement -- Astronaut Boot Camp Activity Log (<https://docs.google.com/document/d/1R6TFlHC6WCfC7brM3NopmAyz5HhjBZtmH86NhGfMUV4/edit>)
* First in Flight Culminating Task Rubric (<https://docs.google.com/document/d/1ltZDl0qNlm35FbkSp3ctFJj7N3ItTF42mVfn-s0h7ts/edit>)
* First in Flight Resource Supplement (<https://docs.google.com/document/d/1Gv2rD6JdaUR6RfnPv-7LLoHXqmdGu5JHXA5dfJVmpQI/edit>)
* First in Flight Social Studies Supplement (<https://docs.google.com/document/d/1WRiO2nJdFk3f1Wi6nNwup9FkhU1pO46LoJyg8xS3NfQ/edit>)
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| **Comments**  | The activities in this lesson were initially created with libraries and other informal science centers in mind. In working with the North Carolina Science Festival, we developed curriculum to reach libraries across the state to teach elementary students about the sciences that make flight possible. The few activities I selected for this plan seemed to work best in my classroom, and also led up to my culminating task I had planned for my solar system, physics, and economy unit. |
| **Author Info**  | **Kenan Fellow**: Allison Stewart**Email**: allison.rae12@gmail.com; arstewart@chccs.k12.nc.us **Bio**: My name is Allison Stewart and I’m a third year teacher teaching third grade at FPG Bilingue in Chapel Hill, North Carolina. The school is a Spanish dual language immersion magnet school in the Chapel Hill-Carrboro City Schools system. In our dual language program, third graders spend half their days in English and half their days in Spanish. Students have reading and a project block in English and math and a project block in Spanish. These project times are PBL-based blocks where students engage in interactive science, social studies, and writing concepts.**Mentor**: Jonathan Frederick**Workplace**: Morehead Planetarium and Science Center - UNC Chapel Hill**Job**: Director of the NC Science Festival**Description**: The NC Science Festival, now in its 5th year, is a statewide initiative to highlight the educational, cultural and financial impact of science in our state.**Qualifications**: BS in Biology, former Science Program Manager at Morehead Planetarium and Education Director at The Summit Environmental Education Center at Haw River State Park**Email**: jfred@unc.edu **Mentor**: Marissa Hartzler**Workplace**: Morehead Planetarium and Science Center - UNC Chapel Hill**Job**: NC Science Festival Statewide Programs Coordinator**Description**: The NC Science Festival, now in its 5th year, is a statewide initiative to highlight the educational, cultural and financial impact of science in our state. As the Programs Coordinator, I predominantly work with our K-12 partners to bring engaging and hands-on science programs to schools.**Qualifications**: Masters in Conservation Science, former director of informal education center in NJ**Email**: hartzler@unc.edu |