

CAMP INVENTION FLIGHT LAB™ ALIGNED TO COMMON CORE AND NEXT GENERATION SCIENCE STANDARDS

KEY CONCEPTS

- Edwin Link invented the Flight Simulator, which is used to safely train pilots in a variety of scenarios on the ground.
- Pilots must maintain a pilot logbook to document and track flight mileage and other data.
- Pilots use unique aviator call signs, which contain fun names and numbers, to easily identify each other when communicating over radio.
- Lift, weight, thrust, and drag are the four main forces to achieve flight.
- Altitude is the height of an object in relation to the ground, and can be measured or estimated using standard and nonstandard tools.
- Flight and aircraft are heavily inspired by watching animals fly and observing plants, such as maple seeds, disperse through the wind.
- Propellers on helicopters provide lift and also vertical thrust.
- Biomimetics, or biomimicry, is the application of nature to designing and solving problems.
- Flying objects made out of different materials and shapes have different properties that affect how they fly.
- Rocket science uses laws of motion, forces and energy, and mathematics.
- Rocket launching requires energy for lift off, usually in the form of rocket fuel.
- Radar technology is used by pilots to navigate during low visibility, similar to how bats navigate using echolocation.
- Angles are measured in degrees and can represent how far an object is tilted up away from a level surface.
- The trajectory or flight path of an object can be changed by different launch angles and force of launch. This also changes the range and landing location of the object.
- Simple machines are mechanical devices for applying force, and can be found inside of robots and aircraft, and in nature.
- The shape of plane and animal wings can be altered to change the flight behavior of the aircraft or animal, such as flying in a looping or dive pattern.

OBJECTIVES

Children will:

- Create an animal and weather-inspired Aviator Call Sign for themselves.
- Test the lift capabilities of different flying objects at Lift Simulation Stations.
- Measure the altitude of a rocket using a yardstick and visual comparative estimates.
- Explore how maple and dandelion seeds inspired propellers and experiment with a DIY Seed Copter.
- Explore Bernoulli's Principle and the forces necessary to attain liftoff.
- Earn Wing stickers and air miles for completing daily flight simulation challenges to add to their LINK robot.
- Explore thrust by blowing on a pinwheel attached to a LINK robot (Primary) or testing how the angle and shape of propeller blades attached to a Link robot affect the amount of wind generated (intermediate).
- Explore how aircraft design is inspired by nature.
- Fold paper airplanes with nature-inspired designs.
- Throw paper airplanes to provide thrust, testing how different wing shapes and added weights affect the trajectory and flight behavior of the glider.
- Launch gliders through hoops and at Trainer LINK's illuminated target.
- Personalize and add flight-inspired decoration to their LINK robot.
- Build a cityscape with skyscrapers, bridges, and other features using recyclables.
- Launch cotton swabs as "rain" towards a city and incoming aircraft at different angles.
- Explore the principles of radar and echolocation for navigation when vision is hindered.
- Test the flying capabilities pullback airplanes as they are launched above a cityscape.
- Take apart a LINK robot using real tools.
- Investigate and identify the simple machines and other mechanics found inside LINK, discover how they function inside of LINK, and explore how they relate to the parts and mechanics of an airplane.
- Build an illuminated Launch Tower using recyclables and incorporating upcycled parts and pieces from the LINK robot Take Apart.
- Launch and operate a heliball during an unmanned flight simulation.

- Launch dream feathers using a straw attached to their LINK robot.
- Graduate from Camp Invention Flight Lab and earn their wings.

CAMP INVENTION FLIGHT LAB™ ALIGNED TO NEXT GENERATION SCIENCE STANDARDS K-6

KINDERGARTEN–GRADE TWO

K-2-ETS1 ENGINEERING DESIGN

- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3 ENGINEERING DESIGN

- K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

GRADE THREE–FIVE

3-5-ETS1 ENGINEERING DESIGN

- 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.

GRADE SIX–EIGHT

MS-PS2-2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

KINDERGARTEN

K-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

GRADE ONE

1-PS4 WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER

- 1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4-2. Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.

1-LS1 FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES

- 1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

GRADE TWO

2-PS1 MATTER AND ITS INTERACTIONS

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

GRADE THREE

3-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 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-ESS3 EARTH AND HUMAN ACTIVITY

- 3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

GRADE FOUR

4-PS3 ENERGY

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

GRADE FIVE

5-PS2 MOTION AND STABILITY: FORCES AND INTERACTIONS

- 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

CAMP INVENTION FLIGHT LAB™ ALIGNED TO COMMON CORE STATE STANDARDS FOR MATHEMATICS K-6

KINDERGARTEN

COUNTING AND CARDINALITY K.CC

Know number names and the count sequence.

- K.CC.3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).

Count to tell the number of objects.

- K.CC.4 Understand the relationship between numbers and quantities; connect counting to cardinality.
 - a. When counting objects, say the number names in standard order, pairing each object with one and only one number name and each number name with one and only one object.
 - b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
 - c. Understand that each successive number name refers to a quantity that is one larger.

MEASUREMENT & DATA K.MD

Describe and compare measurable attributes.

- K.MD.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- K.MD.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.

Classify objects and count the number of objects in each category.

- K.MD.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

GEOMETRY

Identify and describe shapes.

- K.G.1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.

Analyze, compare, create, and compose shapes.

- K.G.5 Model shapes in the world by building shapes from components (e.g., sticks and clay

balls) and drawing shapes.

- K.G.6 Compose simple shapes to form larger shapes. For example, “Can you join these two triangles with full sides touching to make a rectangle?”

GRADE ONE

MEASUREMENT AND DATA

Measure lengths indirectly and by iterating length units.

- 1.MD.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.

Represent and interpret data.

- 1.MD.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

GEOMETRY

Reason with shapes and their attributes.

- 1.G.2 Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.

GRADE TWO

MEASUREMENT AND DATA

Measure and estimate lengths in standard units.

- 2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
- 2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

GRADE FOUR

MEASUREMENT AND DATA

Geometric measurement: understand concepts of angle and measure angles.

- 4.MD.5 Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
 - a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through $\frac{1}{360}$ of a circle is called a “one-degree angle,” and can be used to measure angles.

b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

CAMP INVENTION FLIGHT LAB™ ALIGNED TO COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS K-6

READING STANDARDS FOR INFORMATIONAL TEXT RI

KINDERGARTEN

- RI1. With prompting and support, ask and answer questions about key details in a text.
- RI3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI4. With prompting and support, ask and answer questions about unknown words in a text.
- RI7. With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).

GRADE ONE

- RI1. Ask and answer questions about key details in a text.
- RI3. Describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI4. Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- RI5. Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.
- RI6. Distinguish information provided by pictures or other illustrations and information provided by the words in a text.
- RI7. Use illustrations and details in a text to describe its key ideas.

GRADE TWO

- RI1. Ask and answer such questions as *who*, *what*, *where*, *when*, *why*, and *how* to demonstrate understanding of key details in a text.
- RI4. Determine the meaning of words and phrases in text relevant to a *grade 2 topic or subject area*.
- RI5. Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.
- RI7. Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.

GRADE THREE

- RI1. Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- RI3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- RI4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to *grade 3 topic or subject area*.
- RI5. Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.
- RI7. 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).

GRADE FOUR

- RI1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI3. Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- RI4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 4 topic or subject area*.
- RI7. Interpret information presented visually, orally, or quantitatively (e.g., charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

GRADE FIVE

- RI3. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- RI4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

GRADE SIX

- RI7. Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

WRITING STANDARDS W

KINDERGARTEN

- W2. Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

- W8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

GRADE ONE

- W8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

GRADE TWO

- W7. Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- W8. Recall information from experiences or gather information from provided sources to answer a question.

GRADE THREE

- W8. Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

GRADE FOUR

- W8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

GRADE FIVE

- W8. Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

SPEAKING AND LISTENING STANDARDS SL

KINDERGARTEN

- SL1. Participate in collaborative conversations with diverse partners about *kindergarten topics and texts* with peers and adults in small and larger groups.
 - a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about topics and texts under discussion).
 - b. Continue a conversation through multiple exchanges.
- SL2. Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.
- SL3. Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- SL4. Describe familiar people, places, things, and events, and, with prompting and support, provide additional detail.

- SL5. Add drawings and other visual displays to descriptions as desired to provide additional detail.
- SL6. Speak audibly and express thoughts, feeling, and ideas clearly.

GRADE ONE

- SL1. Participate in collaborative conversations with diverse partners about *grade 1 topics and texts* with peers and adults in small and larger groups.
 - a. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
 - b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
 - c. Ask questions to clear up any confusion about the topics and texts under discussion.
- SL2. Ask and answer questions about key details in a text read aloud or information presented orally or through other media.
- SL3. Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.
- SL4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.
- SL5. Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- SL6. Produce complete sentences when appropriate to task and situation. (See grade 1 Language standards 1 and 3 on page 26 for specific expectations.)

GRADE TWO

- SL1. Participate in collaborative conversations with diverse partners about *grade 2 topics and texts* with peers and adults in small and larger groups.
 - a. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
 - b. Build on others' talk in conversations by linking their comments to the remarks of others.
 - c. Ask for clarification and further explanation as needed about the topics and texts under discussion.
- SL2. Recount and describe key ideas or details from a text read aloud or information presented orally or through other media.
- SL3. Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.

- SL4. Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.
- SL6. Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification. (See grade 2 Language standards 1 and 3 on page 26 for specific expectations.)

GRADE THREE

- SL1. 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.
 - b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
 - c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
 - d. Explain their own ideas and understanding in light of the discussion.
- SL2. Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL3. Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
- SL4. 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.
- SL6. Speak in complete sentences when appropriate to task and situation in order to provide requested detail and clarification. (See grade 3 Language standards 1 and 3 on page 28 for specific expectations.)

GRADE FOUR

- SL1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and in teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.
 - b. Follow agreed-upon rules for discussions and carry out assigned roles.
 - c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
 - d. Review key ideas expressed and explain their own ideas and understanding in light of the discussion.
- SL2. Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL4. Report on a topic or text, tell a story, or recount an experience in an organized manner,

using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

GRADE FIVE

- SL1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.
 - b. Follow agreed-upon rules for discussions and carry out assigned roles.
 - c. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
 - d. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
- SL2. Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL4. Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

GRADE SIX

- SL1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 6 topics, texts, and issues*, building on others' ideas and expressing their own clearly.
 - b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.
 - c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.
 - d. Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.
- SL2. Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

LANGUAGE STANDARDS L

KINDERGARTEN

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing and speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *kindergarten reading and content*.

GRADE ONE

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 1 reading and content*, choosing flexibly from an array of strategies.

GRADE TWO

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 2 reading and content*, choosing flexibly from an array of strategies.

GRADE THREE

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on *grade 3 reading and content*, choosing flexibly from a range of strategies.

GRADE FOUR

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 4 reading and content*, choosing flexibly from a range of strategies.

GRADE FIVE

- L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown multiple-meaning words and phrases based on *grade 5 reading and content*, choosing flexibly from a range of strategies.

GRADE SIX

- L1. Demonstrate command of conventions of standard English grammar and usage when writing or speaking.
- L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on *grade 6 reading and content*, choosing flexibly from a range of strategies.

READING STANDARDS FOR LITERACY IN HISTORY/SOCIAL STUDIES RH

GRADE SIX

- RH4. Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.

READING STANDARDS FOR LITERACY IN SCIENCE AND TECHNICAL SUBJECTS RST

GRADE SIX

- RST3. Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.