Family Involvement Model/Core Component #1: Family Nights

Family Nights are hands-on, STEM (science, technology, engineering, and mathematics) focused activities for families and children to work on together, within the school setting. Family Night sessions are typically 1 to 3 hours in duration.

When properly executed, Family Nights can provide families with an opportunity to explore, learn, and discover together. Designed to be fun, informative, and educational, family nights can be used to help foster a cooperative spirit for learning amongst students, parents/caregivers, teachers, and entire communities.

Provided for you in the following pages are three tried-and-true Family Night programs that have yielded tremendous participation and positive feedback. These activities were selected based upon their ability to be easily replicated within the NASA Explorer School environment.

Family Night

Session Title:	Water + Rockets = Energy + Fun!
Co-Facilitator:	**A teacher or NES team member (with an informed background)**
Session Topic:	Families design and launch bottle rockets together.
Session Objectives:	Family Night participants will • Design, construct, and launch a simple bottle rocket. • Achieve the highest altitude possible by varying the rocket design and the fuel-to-air mixture. • Work as a team to problem solve.
	National Standards and Process Skills Addressed: <u>Science Standards</u> Science as Inquiry; Physical Science; Science and Technology <u>Science Process Skills</u> Observing; Measuring; Inferring; Predicting; Experimenting; Controlling Variables; Making Models; Investigating <u>Mathematics Standards</u> Problem Solving; Numbers and Operations; Geometry; Measurement; Connections
Background Information:	2-liter bottle rockets are excellent devices for investigating Newton's Three Laws of Motion. • First Law—The rocket will remain on the launch pad until an unbalanced force is exerted propelling the rocket upward. • Second Law—The amount of force depends upon how much air you pumped inside the rocket. You can increase the force further by adding a small amount of water to the rocket. This increases the mass the rocket expels by the air pressure. • Third Law—Finally, the action force of the air (and water) as it rushes out the nozzle creates an equal and opposite reaction force propelling the rocket upward.

Resources:	**Web Sites:** Water Rockets Home Page http://exploration.grc.nasa.gov/education/rocket/BottleRocket/index.htm Beginners Guide to Rockets http://exploration.grc.nasa.gov/education/rocket/bgmr.html Brief History of Rockets http://www.grc.nasa.gov/WWW/K-12/TRC/Rockets/history_of_rockets.html Rockets—An Educator's Guide With Activities http://www.nasa.gov/pdf/58269main_Rockets.Guide.pdf
Estimated Length:	**Part 1:** **Introduction**
10 Minutes	Using NASA materials show a video clip of a rocket launching. Next, group families by tables then brainstorm on successful rocket designs and the variables responsible. (It is nice to have the groups write down their ideas on a large piece of paper and this can be put on the wall so that all groups can refer to the information.) Share the ideas from each group.
	Materials/Supplies • Large paper or large post-it easel pad • Tape • NASA video tape/DVD • VCR–DVD player • Video monitor (Note: an LCD projector and slide screen can be used in place of the video monitor.) **Resources for the video:** NASA CORE Web site http://catalog.core.nasa.gov/
Estimated Length:	**Part 2:** **Mission Briefing**
10 Minutes	Explain to the audience that NASA is looking for the most promising family who together can design a hydro-rocket that will reach substantial heights during flight. Let them know that the rocket will be judged by a NES appointed committee who will take into consideration the height of flight, creativity of design, and the rocket's overall performance. Let them know that each family will be a design team and will determine a name for their company. Next, explain what materials are available and how the rocket works. The body of the rocket is made from a 2-liter soda pop bottle. Before launch, the bottle is filled with some amount of water, which acts as the "propellant" for

	the launch. After "fueling" the rocket, a hollow launch tube is inserted into the open end of the rocket. The other end of the launch tube is connected to an air pump which pressurizes the water inside of the rocket. Since water is about 100 times heavier than air, the expelled water produces more thrust during the launch than compressed air alone. The fins attached to the bottom of the body tube will provide stability during the flight. After leaving the launch pad, the rocket begins the coast phase of the flight. The vehicle slows down under the action of the weight and aerodynamic drag and eventually reaches some maximum altitude which can be measured using some simple length and angle measurements and trigonometry. The rocket then begins to fall back to Earth under the power of gravity. If time permits, a parachute recovery system can be used to bring the rocket gently back to the ground. After recovering the rocket, it can be flown again. Inform everyone that the launchers will be ready for the testing of the rockets as soon as a design team is ready. Each design team needs to designate a • Chief Engineer • Materials Engineer • Investigation Recorder Engineer • Assistant Engineer Each design team should independently determine the number, shape and placement of the fins, the shape of the nose cone, and the amount of water needed for a launch. The recorder will keep track of the design used and altitude reached for each trial launch. Name tags with the design team titles should be available to easily identify team members. Information sheets are helpful to stimulate discussion and to get the group started. (The groups will use their original ideas but you can show pictures.)
	Materials/Supplies • Information sheets • Name tags • Notebook paper • Pencils/markers
Estimated Length:	**Part 3:** **Rocket Design and Construction**
45 Minutes	Each design team will make a rocket, launch it, redesign the rocket, and launch it again. During the time allotted, each team will be allowed as many trial launches as needed to develop the best designed rocket. (Design teams should plan on a minimum of 5 to 7 minutes for redesign and repair work between launches.) For instructions on how to design and launch rockets, see appendix C (Educator Information: Bottle Rocket). You can purchase or build a launcher. For instructions on how to build a launcher, see appendix C (Instructions for Building a Launcher).

	Materials/Supplies • 2-liter bottle • Glue gun • Cardstock of various colors • Construction paper in various colors • Tape • Safety goggles • Caution tape • Bicycle pump • "Building a Bottle Rocket" handout for each team. • Launch pad <u>Special Note:</u> Safety should always be the number one priority at any Family Night event. For this activity, safety goggles must be worn by all participants at the launch site.
Estimated Length:	**Part 4:** **Official Launch**
25 Minutes	The final design will be launched from each design team. All design teams should gather together for the Official Launch Competition, supporting each other.
	Materials/Supplies • Safety goggles • Caution tape • Bicycle pump • Launch pad <u>Special Note:</u> Safety goggles must be worn by all participants at the launch site and adult supervision is required at all times. Restricted access to the launch pad should be strictly enforced throughout the event.
Estimated Length:	**Part 5:** **Debriefing**
15 Minutes	Each group will join two other Family Design teams and brainstorm the characteristics that provided the best lift for the rockets. These characteristics are recorded on a big piece of paper and placed on the wall as the groups share with the entire group of teams.
	Materials/Supplies • Large paper or large post-it easel pad • Tape

Estimated Length:	**Part 6:** **Introduce the Home Activity/Wrap-Up** At Home With the Bubble-Powered Rockets
10 Minutes	Build a bubble-powered rocket! Each family should receive the design instructions, but it should be noted that these are simply the beginning. The design teams need to modify the bubble-powered rocket as they work with the designs and keep track of which design gives the greatest lift to the rocket.
	Materials/Supplies • Large Ziploc® (SC Johnson) storage bag (to hold the materials) • Build a bubble-powered rocket design instructions and data collection sheet • 33-mm lid • Effervescing (fizzing) antacid tablets • Cardstock or colored construction paper Special Note: Families should be informed that cellophane tape, scissors, and paper towels will be needed to complete this "at home" science activity. Additionally, families should be reminded that safety is still a number one priority. Safety goggles/glasses (plastic sunglasses can be substituted) should be worn during all "at home" launches.
Career Extension:	There are many NASA careers that involve space flight or support research in this field. Use the URLs below to learn more about these and other NASA career options. Astroventure (Career) Fact Sheets http://astroventure.arc.nasa.gov./teachers/fact_sheets.html NASA People http://quest.nasa.gov/services/people.html Careers: On-Line Resources http://www.nasa.gov/audience/foreducators/topnav/subjects/careers/ NASA Jobs: Student Opportunities http://www.nasajobs.nasa.gov/studentopps/employment/default.htm

Additional supporting materials for this activity have been provided for you in appendix C.

Family Night

Session Title:	Fun With Hot Air Balloons!
Co-Facilitator	**A Teacher or NES Team member (with informed background)**
Session Topic:	Families build a hot air balloon together.
Session Objectives:	Family Night participants will • Discover buoyancy as a factor in balloon flight. • Gain knowledge about the properties of matter. • Come to know the motions and forces associated with the transfer of energy. • Utilize the scientific method and an investigative approach to problem solving.
	National Standards and Process Skills Addressed: <u>Science Standards</u> Science as Inquiry; Physical Science; Science and Technology; History and Nature of Science <u>Science Process Skills</u> Observing; Measuring; Communicating; Predicting; Experimenting; Making Models; Investigating <u>Mathematics Standards</u> Numbers and Operations; Geometry; Measurement; Connections; Data Analysis and Probability

Background Information:	People have always been fascinated with flight. Ancient literature abounds with stories of flight. The Montegolfier brothers, Joseph and Etienne, invented the first hot air balloon. They noticed one day that the smoke from a candle rose. They tried an experiment of placing a paper bag over a candle. To their amazement, the bag rose to the ceiling. Although, they first believed that it was the smoke that caused the bag to rise, it would later be discovered that it was actually hot air that was rising. They used this simple experiment to conduct more complicated experiments involving bigger balloons. Soon they were sending up animals (roosters, sheep, and ducks), all of which returned safely. Finally, on November 21, 1783, two men, Jean Francois Pilatre de Rozier and Marquis d'Arlandes from the court of King Louis XVI, volunteered to go aloft in a hot air balloon. They rose 500 feet into the air and landed several miles away in the field of a farmer. Today, there are over 5000 balloon pilots in the United States alone.
Resources:	**Web Sites:** Learning Technologies Project: Hot Air Balloon http://www.lerc.nasa.gov/WWW/K-12/TRC/Aeronautics/Hot_Air_Balloon.html Science Behind Hot Air Balloons http://imagine.gsfc.nasa.gov/docs/ask_astro/answers/970106a.html Buoyancy: Archimedes Principle http://www.lerc.nasa.gov/WWW/K-12/WindTunnel//Activities/buoy_Archimedes.html
Estimated Length:	**Part 1:** **Introduction**
10 Minutes	Show footage of a hot air balloon, many videos are available online. The group facilitator will place a plastic garbage bag over a hair dryer. (Seal the bag using cellophane tape because when holding the mouth of the bag closed, it will get very hot!) Have families brainstorm what will happen. After sharing their ideas, the facilitator will let the bag go and the families will observe what happens. Then each family will write a hypothesis about why the bag rose.
	Materials/Supplies • Plastic dry cleaner bags or lightweight plastic garbage bags • Industrial strength hair dryer • Tape
Estimated Length:	**Part 2:** **Mission Briefing Design and Development**
60 Minutes	Using the materials given, each family will first design and then build a hot air balloon that will carry a clay figure aloft.

	Each family will draw a diagram of their hot air balloon, and then construct their hot air balloon from the materials provided. Special Note: a balloon panel template is provided, but, of course, the family is welcome to produce an entirely original design! The basket can be made from a green produce basket (like the plastic ones that hold strawberries) or the family can design their own basket with paper, or cardboard. The "figure" can be made out of modeling clay (small plastic figurines can be substituted).
	Materials/Supplies • Paper • Pencils • Assorted color tissue paper • Glue sticks (white school glue can be substituted for this item) • Hot air balloon assembly instructions • Hot air balloon panel template • Modeling clay • Strawberry baskets • String or thread • Cardboard
Estimated Length:	**Part 3:** **The Official Launch**
30 Minutes	The hot air balloons will be launched together (two at a time). <u>If possible:</u> Invite a balloon team from a local hot air balloon club to demonstrate the filling of the balloon and maybe schedule a day for tethered balloon rides.
	Materials/Supplies • Heat source (industrial hair dryer, camping cook stove, etc.) • Matches • Kite string • 8-inch-diameter stove pipe (only needed if using camping cook stove) • Fire extinguisher • Oven mitts <u>Special Note:</u> Safety should always be the number one priority at any Family Night event. For this activity, it is essential that a fire extinguisher and fireproof blanket be readily available at the launch site. Oven mitts must be used to handle the 8-inch-diameter stove pipe if it is being used with the camping cook stove.

Estimated Length:	**Part 4:** **Take It Home/Wrap-Up** Floating to Earth
10 Minutes	Introduce the home-based activity for the families to continue the investigation. Building parachutes would continue the discovery processes and families would enjoy the activity together.
	Materials/Supplies • Large Ziploc storage bag (to hold the materials) • Paper • Thread • Plastic garbage bag • Coffee filters • String • Small plastic figure • Land Your Skydiver Safely! worksheet Special Note: Families should be informed that cellophane tape and scissors will be needed to complete this "at home" science activity. Additionally, families should be reminded that safety is still a number one priority. Families should be encouraged to provide adult supervision for small children working with scissors.
Career Extension:	There are many NASA careers that involve or support aeronautics research. Use the URLs below to learn more about these and other NASA career options. Astroventure (Career) Fact Sheets http://astroventure.arc.nasa.gov./teachers/fact_sheets.html NASA People http://quest.nasa.gov/services/people.html Careers: On-Line Resources http://www.nasa.gov/audience/foreducators/topnav/subjects/careers/ NASA Jobs: Student Opportunities http://www.nasajobs.nasa.gov/studentopps/employment/default.html

Family Night

Session Title:	The Sparkling Night Sky!
Session Topic:	Families studying the night sky (stars) together.
Session Objectives:	Family Night participants will • Come to understand what a constellation is and be able to identify several common ones in the night sky. • Discover some of the legends surrounding the constellations that have been passed down from generation to generation by different populations from around the globe. • Be able to explain how telescopes work and why astronomers use them. • Learn how the night sky appears to change as the Earth rotates around the Sun. • Be able to identify the differences between a planet and a star.
	National Standards and Process Skills Addressed: <u>Science Standards</u> Science as Inquiry; Physical Science; Earth and Space Science; Science and Technology <u>Science Process Skills</u> Observing; Measuring; Inferring; Predicting; Experimenting; Communicating; Making Models; Investigating <u>Mathematics Standards</u> Problem Solving; Numbers and Operations; Geometry; Measurement; Connections

Background Information:	Stars are huge exploding balls of gas (mostly hydrogen and helium) that vary in size and color. Unlike planets which reflect light, stars generate both light and heat. On a clear dark night, you can see about 1000 to 1500 stars. Trying to tell which is which is can be hard. Constellations help astronomers (and others) by breaking up the sky into more manageable bits. Constellations are groups of stars that appear to form imaginary shapes in the sky. It is important to remember that constellations are totally imaginary things that poets, farmers, and astronomers have made up over the past 6000 years. The real purpose for the constellations is to help people tell which stars are which.
Resources:	**Web sites to add information:** Constellation in a Canister http://www.nasa.gov/audience/forkids/activities/A_Constellation_in Canister.html Liftoff to Space Exploration: The Constellations http://liftoff.msfc.nasa.gov/academy/universe/CONSTELLATION HTML Science@NASA: Astronomy http://science.nasa.gov/Astronomy.htm Astronomy Picture of the Day http://antwrp.gsfc.nasa.gov/apod/
Estimated Length:	**Part 1:** **Speakers**
30 Minutes	Invite local graduate students in astronomy or members of a local astronomy club to speak. Usually they will bring some wonderful slides to share. (Be mindful that you may have to request this as well.) Read about some of the stories that describe the names given to the constellations.
	Materials/Supplies • Slide screen • Slide projector (An LCD projector my be substituted for PowerPoint presentations) • Microphone and speaker system

Estimated Length:	Part 2: Planetarium Show
30 Minutes	Offer a Planetarium Show (if available) to illustrate how the same constellation may be named differently by different groups of people and have different stories.
	Materials/Supplies • Visit to a local planetarium (if possible) • Contact a local museum or science center to arrange a StarLab™ Portable Planetarium presentation
Estimated Length:	**Part 3:** **Creating Constellations (Stars)**
30 Minutes	Have each group design constellations by drawing a circle larger than the size of their can on the black construction paper. Next, have each group draw their constellation inside the circle making sure to mark the location of the stars that make up the constellation. When ready, use the pin to punch holes into the construction paper where the stars are located. Using the rubber band, place the new "constellation" on the can. Each family should write a story about this new constellation. (A variation of this activity is to use an overhead projector and black construction paper that would have the "constellation"/the stars punched out.) The outline could be traced with white chalk. After 30 minutes the groups should switch. If possible, have several family groups go outside with the astronomy students or members of the astronomy club to use the telescopes and view the night sky. Constellations should be noted.
	Materials/Supplies • Paper sticker stars • Pencils • Black construction paper • Pins • Coffee cans with both ends removed • Telescopes • Flashlights • Rubber bands • Star cutouts Variation activity—overhead projector would be needed.

Estimated Length:	**Part 4:** **What does my star mean to my family and me?**
30 Minutes	The lights are turned off and each group (family) will shine the flashlight into the can and see the constellation project on the ceiling. The ceiling will be filled with the new constellations. Each family will share their stories that give meaning to their constellation. Each group should have a maximum of 5 minutes to write down one important thing they learned while looking through the telescope. Write this down on a star (paper cut in the outline of a star). On a large piece of black/dark blue construction paper, place the star! **This will be a discussion piece as refreshments are served.** Variation: Using the overhead projector, each family will have a turn putting their "constellation." (Black construction paper with the stars punched out on the projector and telling their story. The lights should be dimmed in the room.)
	Materials/Supplies • Flashlights • Star cutouts • Pins • Coffee cans with both ends removed
Estimated Length:	**Part 5:** **Take It Home** Who Needs a Clock?
10 Minutes	Introduce the home-based initiative activity that includes building a sundial. Begin with questions for the group: • What is the Sun? (star or planet) • Where is the Sun in relation to the earth? • What is the Earth? (star or planet) • How could we keep time using the Sun's movement? The families will be primed and ready to finish this project because of the enthusiasm that is generated by this Family Night!
	Materials/Supplies • Sundial templates • Information sheets about sundials • Sundial building instructions <u>Special Note:</u> Families should be informed that cellophane tape and scissors will be needed to complete this "at home" science activity. Additionally, families should be reminded that safety is still a number

	one priority. Families should be encouraged to provide adult supervision for small children working with scissors.
Career Extension	There are many NASA careers that involve astronomy or support space science. Use the URLs below to learn more about these and other NASA career options. Astroventure (Career) Fact Sheets http://astroventure.arc.nasa.gov./teachers/fact_sheets.html NASA People http://quest.nasa.gov/services/people.html Careers: On-Line Resources http://www.nasa.gov/audience/foreducators/topnav/subjects/careers/ NASA Jobs: Student Opportunities http://www.nasajobs.nasa.gov/studentopps/employment/default.htm