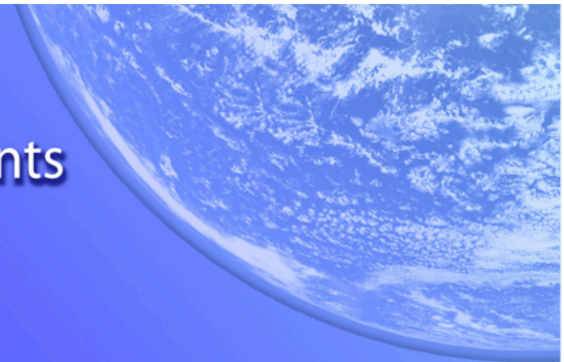


Looking for ideas to get your students excited about math and science?

NASA provides many resources to inspire and engage your students.

And we've made those resources easy to find...

The Democratic Caucus of the House Committee on Science Presents:

NASA Resources for Teachers

www.house.gov/science_democrats/NASAresources.htm

Prepared at the direction of Representative Mark Udall, Member, House Committee on Science

Table of Contents

Nearside of Earth's Moon as Seen
by the Clementine Spacecraft
Photo courtesy of NASA

Our website has even more NASA resources. The outline below details the variety of information available.

Resources for Educators

NASA Resources for Teachers

- General Resources to Get You Started
  - NASA Lesson Plans
  - NASA Office of Education
  - The Space Science Education Resource Directory
  - Science Mission Directorate Education Page
- Visual Resources
  - NASA's downloadable educational materials
  - Models
  - Lunar and/or Meteorite Sample Sets
  - Planetary Photojournal
- Finding resources in your area
  - Education Resource Center Network
  - NASA Space Grant
- Educational Resources from NASA Centers and Affiliates
  - Kennedy Space Center
  - Jet Propulsion Labs
  - Glenn Research Center
  - Marshall Space Flight Center
  - The Lunar and Planetary Institute
  - The Challenger Center for Space Science Education
- NASA opportunities for Schools and Classrooms
  - Imagine Mars
  - NASA Aerospace Education Services
  - International Space Station
  - NASA Kids Science News Network
  - NASA SciFiles
  - Astro-Venture
  - Request a NASA Speaker
  - Traveling Exhibits
  - Robotics Education Page
  - Engineering Design Challenges
- Some more specific ideas
  - Hubble-related pictures and activities
  - The Cassini Mission to Saturn Education and Outreach page
  - 4D climate model
  - Sun-Earth Day
  - Mars for Educators

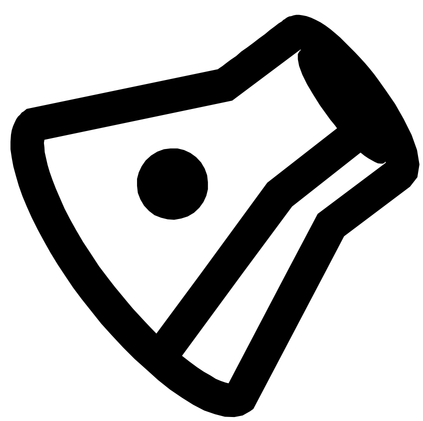
Log on for more information:
http://sciencedems.ouse.gov/resources/nasaresources.htm

- NASA Workshops and Summer Programs for teachers
    - Summer workshops with the NASA Astrobiology Institute
    - NASA Edspace
    - Pre-Service Teacher Institute
    - Resident Research Associateship Program
    - NASA Summer Faculty Research Opportunities (NSFRO)

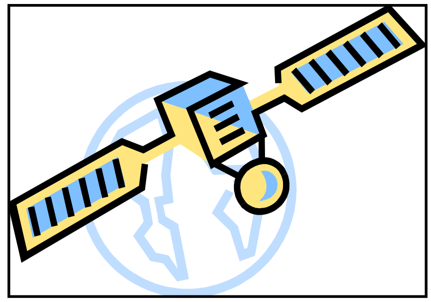
Resources for Students

<u>NASA Resources for Students</u>

- K-8 Resources
    - The NASA Student Involvement Program (NSIP)
    - Space Experiment Module (SEM)
- 9-12 Resources
    - NASA Summer High School Apprenticeship Research Program (SHARP)
    - The NASA Student Involvement Program (NSIP)
    - Dropping In a Microgravity Environment (DIME)
    - The NASA Institute for Advanced Concepts Student Visions of the Future Program (NSVFP)
    - NASA Student Launch Initiative
    - The Great Moonbuggy Race
- Undergraduate and Graduate Resources
    - NASA Academy
    - Microgravity Experiences
    - Lunar and Planetary Institute Summer Internship Program
    - Other Internships from NASA and other sources
    - The NASA Institute for Advanced Concepts Student Visions of the Future Program (NSVFP)
    - NASA Undergraduate Student Research Program
    - NASA Graduate Student Researchers Program
    - The Great Moonbuggy Race
    - NASA Student Launch Initiative
    - NASA Cooperative Education Program
    - Other NASA Internships
- Amazing Images
    - Planetary Photojournal
    - Astronomy Picture of the Day
    - Hubble Images
- Fun and Games
    - For Younger Kids
    - For Older Kids (and Adults)



Educator Resource Center Network (ERCN)



These Centers, located around the country, provide teachers with a local resource to understand and fully utilize NASA education resources. ERCN provides programs and training sessions to assist teachers. There are eleven centers nationwide that each serve the surrounding region.

Page 5 lists ERCN locations and websites by state.

Central Operation of Resources for Educators (CORE)

CORE produces a free catalogue of the many educational materials available through NASA for a small fee. Products include lesson plans, videotapes, multi-media material, NASA memorabilia, and more.

For a free catalogue, please detach and mail in the form below, call (440-775-1400) or visit the CORE website: **http://core.nasa.gov**.

Please send a CORE Catalog to:

Name ______________________ Institution ______________________

❑ Address (please check if home address) ______________________

City, State, ZIP ______________________ Phone number ______________________

Please indicate interest level

❑ K-4 ❑ 5-8 ❑ 9-12 ❑ Community College
❑ Undergratuate ❑ Preservice Teacher ❑ Informal Educator

How did you learn about CORE?

____
____
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____

❑ Please add me to the CORE mailing list

Mail to: CORE
Lorain County JVS
15181 Route 58 South
Oberlin, OH 44074-9799

Regional ERCN Locations

If you live in the state of:	ERCN Location	Contact Information	Website
Alaska, Northern California, Hawaii, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, and Utah	Ames Research Center	Mail Stop 226-8 Moffett Field, CA 94035-1000 650-604-5544	http://erc.arc.nasa.gov/
Arizona, Southern California	Dryden Flight Research Center	38256 Sierra Highway, Suite A Palmdale, CA 93550 661-276-2010	http://www.dfrc.nasa.gov/Education/index.html
California	Jet Propulsion Laboratory	1460 East Holt Ave. Suite 20 Pomona CA 91767 909-397-4420	http://education.jpl.nasa.gov/erc.html
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	Glenn Research Center	21000 Brookpark Rd. MS 8-1 Cleveland, OH 44135 216 433-2017	http://www.nasa.gov/centers/glenn/education/ERC_GRC.html
Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	Goddard Space Center	Mail Code 130.3 Greenbelt, MD 20771-0001 301-286-8570	http://www.gsfc.nasa.gov/vc/erc.html
Eastern Shores of Maryland and Virginia	GSFC/Wallops Flight Facility	Building J-17 Wallops Island, VA 23337 757-824-2214	http://www.wff.nasa.gov/~WVC/erc.htm
Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas,	Johnson Space Center	1601 NASA Road One Houston, TX 77058-3696 281-244-2129	http://spacecenter.org/educator_resource.html
Florida, Georgia, Puerto Rico, Virgin Islands,	Kennedy Space Center	Mail Code ERC FL 32899-0001 321-867-4090	http://education.ksc.nasa.gov/erc/erc.htm
Kentucky, North Carolina, South Carolina, Virginia, West Virginia,	Langley Research Center	600 Settlers Landing Rd. Hampton, VA 23681-0001 757-727-0900 Ext. 757	http://www.vasc.org/erc/
Alabama, Arkansas, Iowa, Louisiana, Missouri, Tennessee	Marshall Space Flight Center	US Space & Rocket Center One Tranquility Base Huntsville, AL 35807 256-544-5812	http://erc.msfc.nasa.gov/
Mississippi	Stennis Space Center	Building 1200 MS 39529-6000 800-237-1821 Opt. #2	http://education.ssc.nasa.gov/erc/default.htm

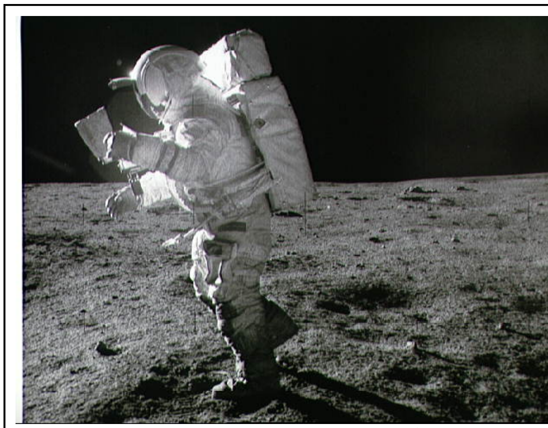
Space Grant

The National Space Grant College and Fellowship Program (also known as Space Grant) was initiated by NASA in 1989. Space Grant is a national network of colleges and universities working to expand opportunities for Americans to understand and participate in NASA's aeronautics and space programs by supporting and enhancing science and engineering education, research, and public outreach programs. The Space Grant national network includes over 850 affiliates from universities, colleges, industry, museums, science centers, and state and local agencies. These affiliates belong to one of 52 consortia in all 50 United States, the District of Columbia and the commonwealth of Puerto Rico.

The 52 consortia fund fellowships and scholarships for students pursuing careers in Science, Mathematics, Engineering and Technology, as well as provide small faculty awards for curriculum enhancement and development programs. Member colleges and universities also administer pre-college and public service education programs in their states.

While each state's Space Grant program is different, most offer opportunities for speakers from local universities or museums to come to your classroom and speak about science and space related topics. In addition, they may coordinate other exciting outreach programs in your area.

Many Space Grant programs also make available small awards to teachers for classroom activities and/or professional development. Some may be linked to specific Space Grant programs within each state's consortium, or they may be more open and responsive to individual teacher needs. Check with the Space Grant coordinator in your state to find out what programs are available to you.



Astronaut David Scott on the slope of Hadley Delta during Apollo 15 extravehicular activity
Photo courtesy of NASA

Visit this Web site to discover how the National Space Grant College and Fellowship Program is organized: **http://calspace.ucsd.edu/spacegrant/**. There is also a handy clickable map to link you directly to your state's Space Grant Consortia web page.

NASA Visual Resources

Bookmarks and Posters (K-12)

There are a variety of downloadable visual resources that NASA has available, including posters and bookmarks. The bookmarks and posters have interesting images, facts and classroom ideas. Most are also available from the CORE catalogue.

Website: **www1.nasa.gov/audience/foreducators/topnav/materials/listbytype/**

Lunar Sample Sets (K-12)

NASA makes available sample soils and rocks from the Apollo program for teachers to use. Having these samples in the classroom can make lunar studies much more exciting to students. A more detailed description of the process involved in requesting these samples is on page 8 of this booklet.

Website: **www.nasa.gov/centers/johnson/about/factsheets/lunarsamples.html**

Lithographs (K-12)

NASA has lithographs available for each of the planets in our solar system, as well as many other topics. Lithographs have pictures on one side and descriptions, with facts and timelines on the other. Activities involving the topic are often included as well. These can be downloaded as a pdf from the website below or requested from NASA through the CORE catalogue. We have included the "Our Solar System" Lithograph on page 9 to help you explore how these tools can be used in the classroom.

NASA Lithograph of the Moon.
Photo courtesy of NASA

Website: **www.nasa.gov/audience/foreducators/topnav/materials/listbytype**

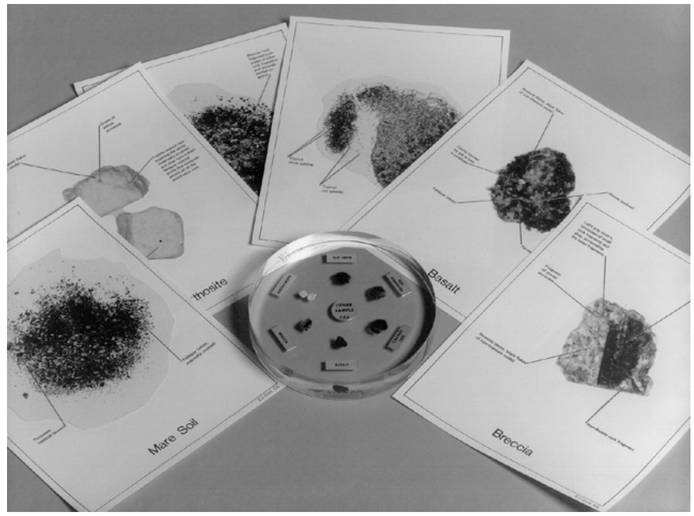
Models (K-12)

NASA provides many models that can be downloaded from the internet, printed, and assembled. The models have a wide range of difficulty and allow a hands-on opportunity for students to learn about NASA planes and satellites. The directions typically include discussion questions and ideas on how the project can be incorporated into the classroom. We have included the "Genesis Mission Spacecraft Model" (4-8) on page 11 to help you explore how to incorporate these resources in your classroom.

Website: **www.nasa.gov/audience/foreducators/topnav/subjects/technology/Models.html**

Lunar Sample Sets: Educational Disk Program (K-12)

This program consists of six samples of lunar material (three soils and three rocks) encapsulated in a 6-inch diameter clear lucite disk. The disk is accompanied by written and graphic descriptions of each sample in the disk; a video presentation; a teacher workbook; and additional printed information. This program was designed as a science teaching aid for the classroom environment.



Lunar Sample Disk and educational materials
Photo courtesy of NASA

Teachers qualify for the use of a disk in their classroom by attending one of the many workshops sponsored by NASA's Space Science Education Specialists to become certified. The certification is good indefinitely. These workshops occur at different locations around the United States throughout the year.

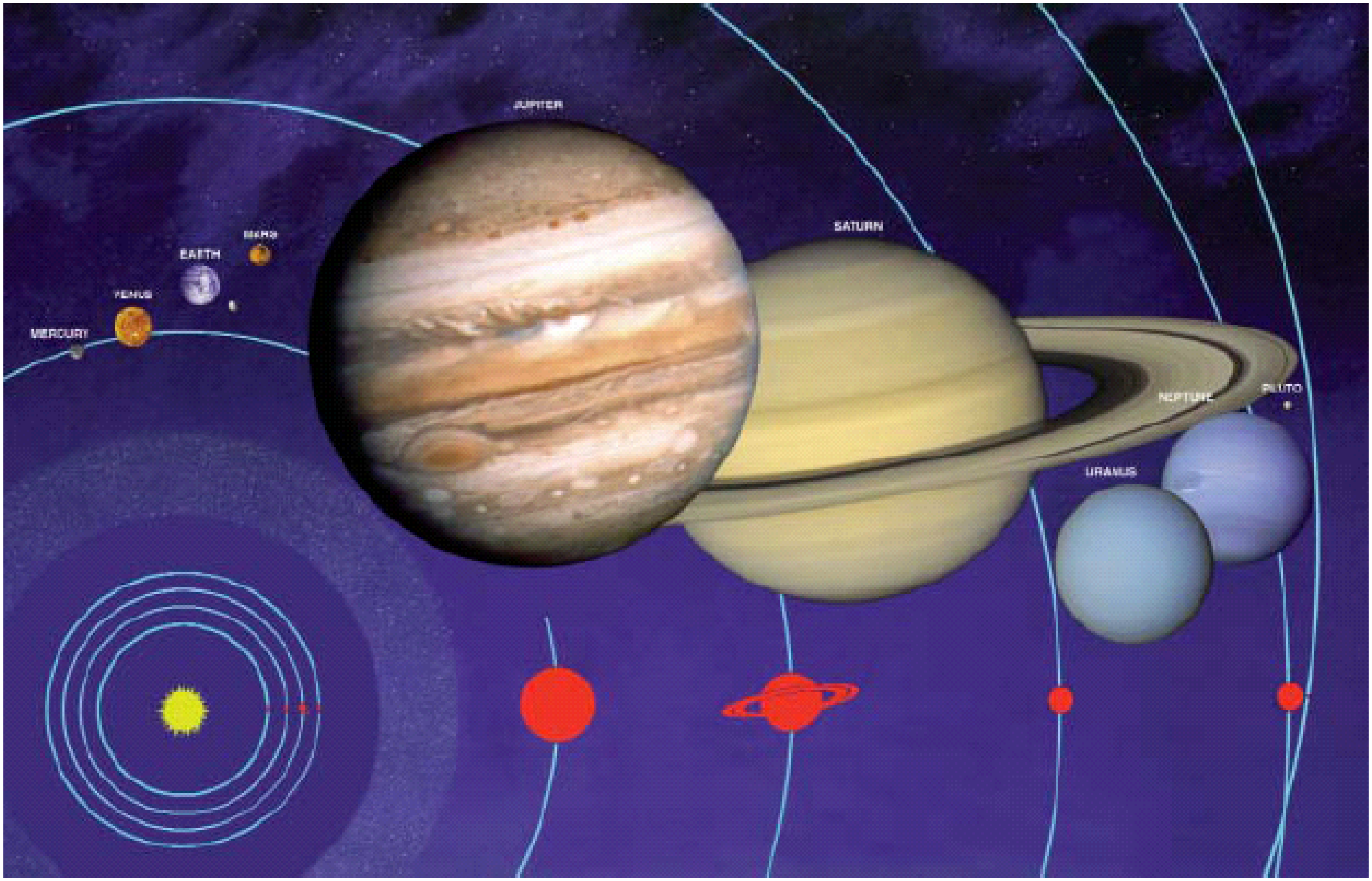
There are a few basic requirements for using the disk. The disk must be secured, while not in use, in a safe or vault-type safe or cabinet with a bar and combination lock; it must be sent via registered mail to and from locations; and it must be under constant surveillance while in use. For additional information, school personnel can contact the Center Education Programs Officer at the appropriate regional center (see page 5).

In addition to the lunar disk, NASA also has a meteorite disk available. The program operates basically the same as the Lunar Disk Program and a single certification is good for both.

Meteorite Sample Set
Photo courtesy of NASA

National Aeronautics and
Space Administration

Our Solar System



From http://www.nasa.gov/pdf/62229main_System_Lithograph.pdf

Our Solar System

From our small world we have gazed upon the cosmic ocean for thousands of years. Ancient astronomers observed points of light that appeared to move among the stars. They called these objects planets, meaning wanderers, and named them after Roman deities—Jupiter, king of the gods; Mars, the god of war; Mercury, messenger of the gods; Venus, the goddess of love and beauty; and Saturn, father of Jupiter and god of agriculture. The stargazers also observed comets with sparkling tails, and meteors or shooting stars apparently falling from the sky.

Since the invention of the telescope, three more planets have been discovered in our solar system: Uranus (1781), Neptune (1846), and Pluto (1930). In addition, there are thousands of small bodies such as asteroids and comets. Most of the asteroids orbit in a region between the orbits of Mars and Jupiter, while the home of comets lies far beyond the orbit of Pluto, in the Oort Cloud.

The four planets closest to the Sun—Mercury, Venus, Earth, and Mars—are called the *terrestrial planets* because they have solid rocky surfaces. The four large planets beyond the orbit of Mars—Jupiter, Saturn, Uranus, and Neptune—are called gas giants. Tiny, distant Pluto has a solid but icier surface than the terrestrial planets.

Nearly all of the planets—and some of the moons—have atmospheres. Earth's atmosphere is primarily nitrogen and oxygen. Venus has a thick atmosphere of carbon dioxide, with traces of poisonous gases such as sulfur dioxide. Mars' carbon dioxide atmosphere is extremely thin. Jupiter, Saturn, Uranus, and Neptune are primarily hydrogen and helium. When Pluto is near the Sun, it has a thin atmosphere, but when Pluto travels to the outer regions of its orbit, the atmosphere freezes and "collapses" to the planet's surface. In this regard, Pluto acts like a comet.

There are at least 91 natural satellites (also called moons) around the various planets in our solar system, ranging from bodies larger than our own Moon down to small pieces of debris. Many of these were discovered by planetary spacecraft. Some of these have atmospheres (Saturn's Titan); some even have magnetic fields (Jupiter's Ganymede). Jupiter's moon Io is the most volcanically active body in the solar system. An ocean may lie beneath the frozen crust of Jupiter's moon Europa, while images of Jupiter's moon Ganymede show historical motion of icy crustal plates. Some planetary moons, such as Phoebe at Saturn, may be asteroids that were captured by a planet's gravity.

From 1610 to 1977, Saturn was thought to be the only planet with rings. We now know that Jupiter, Uranus, and Neptune also have ring systems, although Saturn's is by far the largest. Particles in these ring systems range in size from dust to boulders to house-sized, and they may be rocky and/or icy.

Most of the planets also have magnetic fields, which extend into space and form a "magnetosphere" around each planet. These magnetospheres rotate with the planet, sweeping charged particles with them. The Sun has a magnetic field, the heliosphere, which envelops our entire solar system.

Ancient astronomers believed that the Earth was the center of the universe and that the Sun and all the other stars revolved around the Earth. Copernicus proved that Earth and the other planets in our solar system orbit our Sun. Little by little, we are charting the universe, and obvious questions arise: Are there other planets around other stars? Are there other planets where life might exist? Only recently have astronomers had the tools to indirectly detect large planets around other stars in nearby galaxies. Direct detection and characterization of such planets awaits the development of yet more powerful observing tools and techniques.

The illustration on the reverse side is an artistic representation of the planets' sizes and distances.

Activities

How big is our solar system? To give you a rough idea, consider that it took the *Voyager 2* spacecraft, traveling in a sweeping arc at an average of 65,000 kilometers per hour, 12 years to reach Neptune! How fast is that in meters per second? In feet per second? If you could travel that fast, how long would it take you to reach the next town? To get to the Moon?

Can you build a scale model of the solar system? If you use Earth's diameter as a unit of measure (Earth diameter = 1), figure out how big the other planets are compared to Earth. Hint: divide each planet's diameter by Earth's diameter. What objects might you use to depict the sizes of the Sun and planets? How far away would the planets be from each other? Map out a scale model of the solar system in your town.

	Actual Diameter (km)	Mean Distance from sun (km)	Number of Moons
Sun	1,391,900	0	–
Mercury	4,878	57,910,000	0
Venus	12,104	108,200,0000	0
Earth	12,756	149,600,0001	1
Moon	3,476		–
Mars	6,794	227,940,000	2
Jupiter	142,984	778,330,000	28
Saturn	120,536	1,429,400,000	30
Uranus	51,118	2,870,990,000	21
Neptune	49,528	4,504,300,000	8
Pluto	2,300	5,913,520,000	1

References
1) Views of the Solar System—Solar System: *http://www.solarviews.com*
2) Planetary Photo Journal: *http://photojournal.jpl.nasa.gov*
3) Stardate: *http://stardate.org*

GENESIS MISSION SPACECRAFT MODEL** (4-8)

Supplies Needed

- Printed model components (see below)
- Scissors
- Clear tape or glue (glue stick works well)
- Toothpick or a short piece of pipe cleaner
- Markers, colored pencils, or crayons (optional)

To Assemble the Genesis Spacecraft Model:

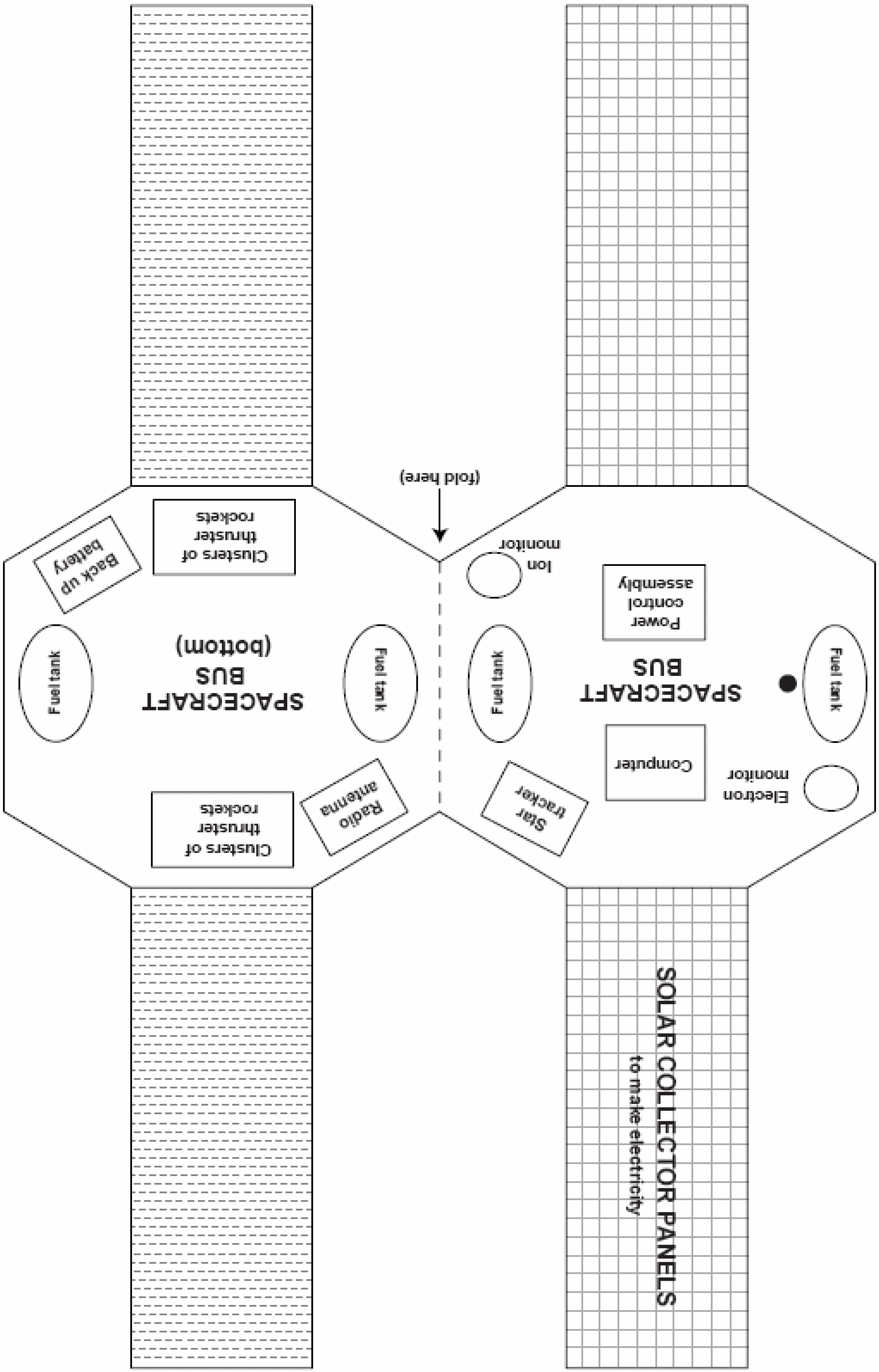
Read all directions carefully before assembly.

1. Copy the spacecraft bus and the capsules and collectors pages following this page.
2. Color the spacecraft pieces (optional).
3. Carefully cut out all of the components.
4. Fold the spacecraft bus on the dotted line and glue or tape the spacecraft bus front and back together, being careful to line up the two pieces so that they match.
5. Curve the side of the Science Canister, glue or tape on the overlap, and glue or tape the edges to the base.
6. Curve the side of the Sample Return Capsule, glue or tape on the overlap, and glue or tape the edges to the base.
7. Push a toothpick or pipe cleaner through the darkened circle on the Spacecraft Bus.
8. Place the Sample Return Capsule on top of the Spacecraft Bus and secure by pushing the toothpick or pipe cleaner through the darkened circle on the base of the Sample Return Capsule.
9. Place the Science Canister inside the Sample Return Capsule and secure by pushing the toothpick or pipe cleaner through the darkened circle on the base of the Sample Return Capsule.
10. Secure the four Collector Arrays by pushing the toothpick or pipe cleaner through the darkened circles, placing the arrays in numerical order. The Arrays should be inside the Science Canister.

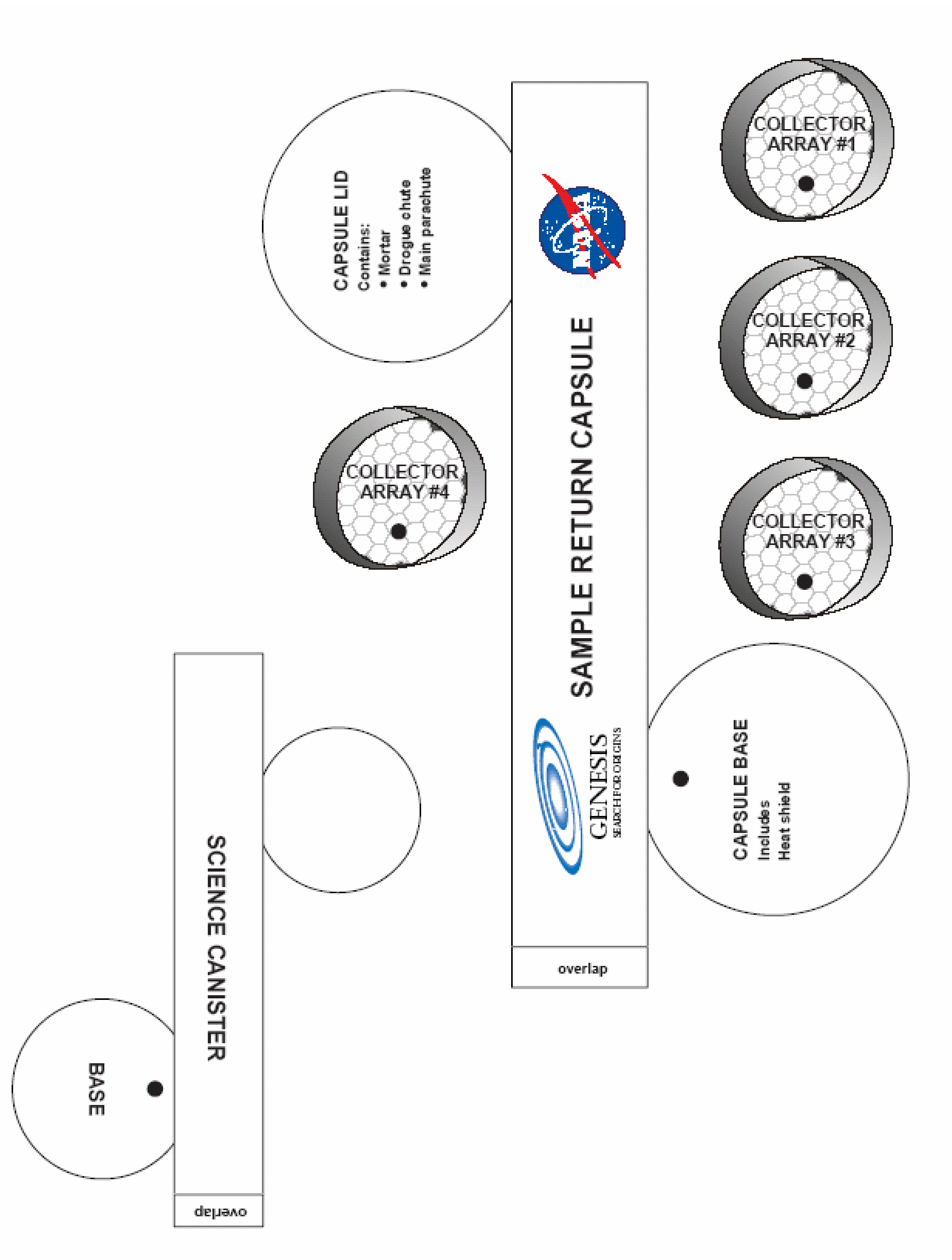
The Finished Piece:

While the Genesis spacecraft is gathering samples, the lids of the Science Canister and Sample Return Capsule will be open. The four Collector Arrays can spread out individually. When the spacecraft is ready to return to Earth, the Collector Arrays will be stored inside the Science Canister, which will be inside the Sample Return Capsule.

**This page has been modified slightly for inclusion in the NASA educators booklet. View the original version at: http://www.genesismission.org/mission/craft/craftmodel.html



From: http://www.genesismission.org/mission/craft/SCModelBus.pdf



 From: http://www.genesismission.org/mission/craft/SCCAPSULES.pdf

NASA Enrichment Opportunities for Students, Schools and Classrooms

NASA Aerospace Education Services

* **NASA Explorer Schools (4-9)**
  Annually, NASA selects 50 NASA Explorer Schools teams for math, science, and technology students. These three year partnerships allow teachers and students to access unique NASA resources. Additional information can be found on page 19 and by visiting the website.

  Website: **http://explorerschools.nasa.gov**

* **Urban and Rural Community Enrichment Program (5-8)**
  This program is designed specifically for middle school students and provides supplemental information for curriculum needs. You can find additional information on page 20 and by visiting the website.

  Website: **http://www.nasa.gov/education/urcep**

International Space Station (ISS)

* **ISS Downlink (K-12)**
  The ISS Downlink offers students the exciting opportunity to interact directly with astronauts aboard the ISS. Although competitive, the program is a great learning tool for schools. You can find additional information on page 21 and by talking to your regional ERCN office (page 5).

* **ISS EarthKAM (5-8)**
  Through ISS EarthKAM, NASA provides amazing images of the Earth from the ISS. Teachers and students can use these images to learn more about the planet that we live on. You can find additional information on page 22 and by visiting the website.

  Website: **www.earthkam.ucsd.edu**

NASA Summer High School Apprenticeship Research Program (SHARP) (10-12)

SHARP is designed to provide a hands-on research experience for students who have demonstrated a strong interest in and aptitude for STEM. NASA selects 400 students annually to work with mentors on NASA-related content at NASA centers and universities. You can find additional information on page 23 and by visiting the website.

Website: **http://www.nasasharp.com/**

Imagine Mars (K-12)

Imagine Mars is a partnership between NASA and the National Endowment for the Arts to teach students about art, science and technology using Mars exploration. Kids are encouraged to design communities on Mars, focusing on music, art, literature, and other humanities, while considering the technological and cultural challenges that would face a Martian community. The program supports an online project gallery for participants to show others what they have created. We included two examples from the *Imagine Mars Participation Guide* to help you understand how you can use this program on page 24.

Website: **http://imaginemars.jpl.nasa.gov/**

Robotics Education Project (K-12)

A robot work crew
Photo courtesy of NASA

The NASA Robotics Education Project (REP) is dedicated to encouraging people to become involved in science and engineering, particularly robotics. REP works to capture the educational potential of NASA's robotics missions by supporting educational robotics competitions and events, facilitating robotics curriculum at all educational levels, and maintaining a web site clearinghouse of robotics education information. The website also includes a listing of robotics competitions for students, as well as funding opportunities for some of these competitions.

Website: **http://robotics.nasa.gov/**

Engineering Design Challenge (5-12)

The Engineering Design Challenges Program connects students in their classrooms with the challenges faced by NASA engineers as they design the next generation of space vehicles, habitats and technology. Working under the supervision of their teachers, middle and high-school students design, build, test, re-design, and re-build models that meet specified design criteria. Students employ the same analytical skills as engineers as they improve their designs. The design challenge culminates in the classroom with each student team preparing a poster that describes the process and results of their work. These projects are designed to help students achieve national goals in science, mathematics, and thinking skills.

The educator guides available on the website instruct teachers on incorporating this program into the classroom.

Website: **http://eto.nasa.gov**

NASA Student Launch Initative (9-12)

The NASA Student Launch Initiative (SLI) involves high school students in designing, building and testing reusable rockets with associated scientific payloads. This unique hands-on experience allows students to demonstrate proof-of-concept for their designs and gives previously abstract concepts tangibility. Several schools compete to construct the vehicle that is designed to reach an altitude of one-mile above ground level. In addition to actual vehicle performance, schools are also evaluated on design and other criteria.

Website: **http://education.msfc.nasa.gov/docs/127.htm**

The Great Moonbuggy Race (9-12)

The Great Moonbuggy Race is a competition where students design and build a moonbuggy that addresses a series of engineering problems similar to problems faced by the original Moonbuggy team during the Apollo missions to the Moon. Each Moonbuggy is human powered and carries two students, one male and one female, over a half-mile simulated lunar terrain course including "craters", rocks, "lava" ridges, inclines and "lunar" soil.

Moonbuggy entries are expected to be of "proof-of-concept" and engineering test model nature, rather than final production models. Each student team of six members is responsible for building their own buggy, and the course drivers, who are chosen from each team, must also be builders of the vehicle.

The competitions occur annually during the spring at the U.S. Space & Rocket Center in Huntsville, AL.

Website: **http://moonbuggy.msfc.nasa.gov/**

Competitors in the Great Moonbuggy Race.
Photo courtesy of NASA

Request a NASA Speaker (K-12)

The NASA Speakers Bureau can provide knowledgeable speakers to your classroom or school. The bureau is comprised of NASA scientists, engineers, managers, and other professionals from Centers throughout the country. They volunteer, taking time from their work schedules, to address the public. Contact the NASA ERCN center nearest you to request a speaker (see the list on page 5).

You can also request a speaking appearance by a NASA astronaut! Unfortunately, due to extensive training requirements for astronauts and the high demand for astronaut appearances, NASA can fulfill only a limited number of appearance requests.

Website: **http://www.nasa.gov/about/speakers/**

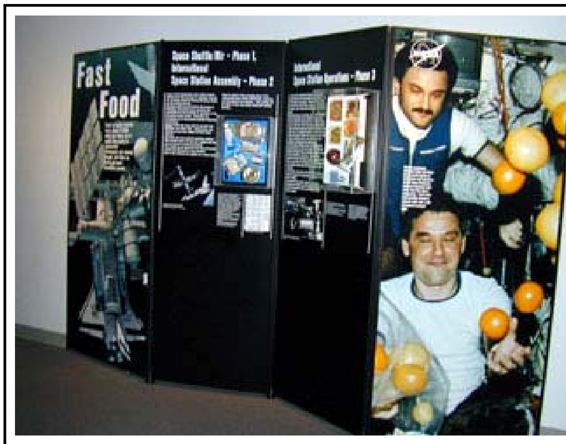
Traveling Exhibits (K-12)

The ERCN centers (listed on page 5) can provide many types of exhibits for use in your classroom or school. From hands-on models that demonstrate aeronautics and space themes, to actual space suits and accessories, to interactive demonstrations, these traveling exhibits present unique insights into air and space travel in the past, present, and future.

Each ERCN operates their own traveling exhibit program. Most of the programs schedule on a first-come, first-served basis. Requests should be submitted at least eight weeks in advance of your event date to allow time for scheduling, processing, and shipping.

While the exhibits associated with each center are different, some of the products available may include:

- Panel exhibits
- Scale models
- Inflatables
- Interactive/instructional demonstrators
- Moon rocks
- Spaceflight suits and accessories



Example of a panel display from NASA Langley Research Center on food in space
Photo courtesy of NASA

Website: **http://www.nasa.gov/centers/glenn/events/exhibits.html**

Space Experiment Module (SEM) (K-12)

SEM gives students the opportunity to design and build experiments to fly on the International Space Station (ISS) or NASA scientific balloons. With the help of a teacher or mentor, students will create, design and build an experiment that focuses on the science of zero-gravity and microgravity.

Space Shuttle Discovery STS-41Launch
Photo courtesy of NASA

The SEM Satchel program takes small experiments to the ISS with astronauts aboard Russian rockets. SEM-B projects fly on NASA scientific balloons 120,000 to 130,000 feet above the ground, right at the edge of space, and provide a very stable environment to test experiments. This program may undergo changes in the near term as NASA determines the project's future. Be sure to contact NASA directly for the latest information.

Website: **http://sspp.gsfc.nasa.gov/sem/about.html**

Dropping in a Microgravity Environment (DIME) (9-12)

DIME is an annual NASA competition that allows teams of high school students to design and build an experiment to test in a NASA microgravity drop tower facility. Students first create a proposal to submit to NASA. A NASA panel evaluates the proposals and selects the four top-ranked ones. In April of each year, these four teams are invited to the NASA Glen Research Center in Cleveland, OH to test their experiments in the NASA 2.2 Second Drop Tower, analyze their data, tour the facilities, and participate in workshops. Each team receives an expense-paid trip for five representatives to the event.

View down the shaft of the 2.2 Second Drop Tower at the Glenn Research Center.
Photo courtesy of NASA

Website: **http://exploration.grc.nasa.gov/DIME.html**

Other Programs

There are a variety of other opportunities available, especially in areas close to a NASA laboratory. Programs may include day camps, school trips, and local student internships. Contact your regional ERCN (see page 5) for additional information.

Become a NASA Explorer School (4-9)

Each year, the NASA Explorer Schools (NES) program establishes a three-year partnership between NASA and 50 school teams, consisting of state certified teachers and education administrators from diverse communities across the country. Schools from across the country are eligible to apply online for an opportunity to partner with NASA in an exciting program designed to bring NASA's engaging mathematics, science, and technology learning to educators, students, and families (**http://explorerschools.nasa.gov**) .

While partnered with NASA, NES teams will acquire and use new teaching resources and technology tools for grades 4-9 using NASA's unique content, experts and other resources. Schools in the program are eligible to receive up to $17,500 over the three-year period to purchase technology tools that support science and mathematics instruction.

NASA Explorer School educator and administrator teams, working alongside NASA personnel and other educational partners, develop and implement strategic plans that bring exciting opportunities to educators, students, and families through:

- Sustained professional development
- Exciting student learning opportunities
- Integration of technology
- Involvement of parents

Teachers from Explorer Schools conduct microgravity experiments aboard the KC-135A "weightless wonder" aircraft.
Photo courtesy of NASA

The NES Strategic Plan designed by each team promotes the use of NASA content and programs that address the teams' local needs in mathematics, science, and technology through real-world experiences. Educators and students in a NASA Explorer School become involved in the excitement of NASA research, discoveries, and missions through participation in engaging NASA learning adventures and scientific challenges.

Students at NASA's current Explorer Schools have had opportunities to participate in such exciting adventures as developing experiments to fly on sounding rockets, aboard NASA's "weightless wonder" (a KC-135A aircraft), and on the International Space Station (ISS). Explorer Schools are also equipped with technology so that they can participating in video conferences with NASA scientists, engineers, and even astronauts aboard the ISS.

Urban and Rural Community Enrichment Program (URCEP) (5-8)

The URCEP is a 3-day intensive program that exposes teachers and middle school students from rural and urban communities to unique educational activities. The URCEP is designed to capture, channel and enhance the interest of participants in science, mathematics, engineering, technology and geography.

For participating schools, the URCEP team helps plan, coordinate, and implement a three-day training program. Using simple demonstrations and scale models of aeronautical and space hardware, the URCEP specialists explain how basic scientific principles are applied in the exploration of aeronautics and space. Major activities include lectures, demonstrations, and hands-on classroom activities that supplement the ongoing curriculum. In addition, workshops and other activities are offered to school personnel.

Special emphasis is placed on communications, logic, and reasoning skills that are curriculum related. The URCEP coordinator supplies technical and logistical assistance.

In preparation for the three-day program, NASA URCEP Specialists train core educators as a team to conduct interdisciplinary aerospace activities in school districts. Superintendents, with suggestions from principals, are asked to select core teachers from schools in their districts. They must represent different disciplines in the school such as mathematics, science, physical education, social studies, fine arts and language arts. The core educators devote six weeks to working with the aerospace program in their schools where they lead interdisciplinary teams of teachers in interactions with the principal and faculty and help prepare for implementing the aerospace programs.

The goals of the URCEP are to:

- Motivate students to improve their reading, writing, and mathematical skills
- Provide greater exposure to aerospace in an interdisciplinary manner,
- Foster direct educator and parent involvement in the aerospace education process,
- Foster greater student awareness of careers in mathematics, science, engineering, technology, and geography,
- Increase educator and community awareness of NASA resources and technical assistance programs that can be used as a supplement to the existing curriculum, and
- Raise awareness of multicultural contributions to aerospace.

Interested school systems may obtain additional information online at **http://aesp.nasa.okstate.edu/URCEP/** or by writing to:
NASA Headquarters; Education Division; Attn: URCEP Program Manager; Code N; Washington, DC 20549.

ISS Downlink (K-12)

Port side view of the ISS in November, 2004
Photo courtesy of NASA

NASA's International Space Station (ISS) Downlink is a program that provides a live connection between schools and astronauts aboard the ISS. NASA created this program to increase awareness of and interest in science, technology, engineering, and math (STEM) programs and careers for elementary and middle school students.

Through the ISS Downlink, students interact directly with the astronauts in space via live video and audio connections, asking questions and observing demonstrations. The downlinks typically last about 20 minutes and are intended to be part of a larger STEM education effort. Examples of potential ISS programs that include an ISS Downlink are:

- Toys in space: Will a boomerang return to you? How does a ball bounce?
- Eating in space: How do you drink in space? What types of food do astronauts eat?
- Life in space: Do plants grow differently in space? What do insects do in space?

You can view a past downlink example at:
http://aesp.nasa.okstate.edu/anderson/crossroadsvideo/crossroads2cc.mov.

To participate in an ISS Downlink, you must fill out an application and submit it to NASA for consideration. The process is very competitive. NASA selects between four and six sites bi-annually.

For additional information, please contact the Teaching From Space Office at nseo@ems.jsc.nasa.gov or (281) 244-2320 or contact your regional ERCN office (see page 5).

<u>ISS EarthKAM (5-8)</u>

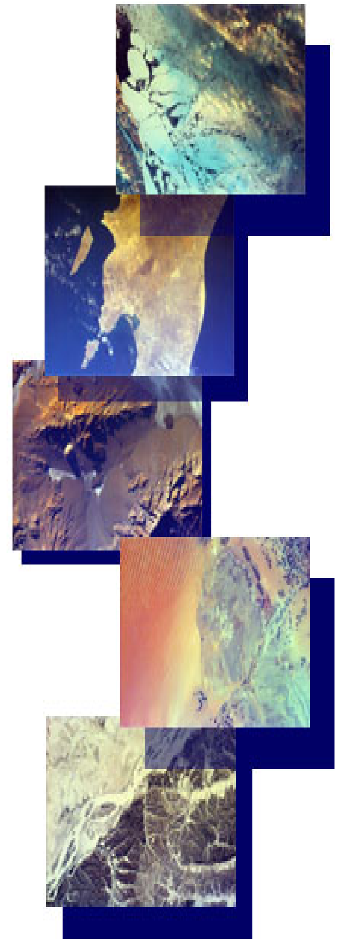


Photo courtesy of NASA

ISS EarthKAM (Earth Knowledge Acquired by Middle school students) allows students, teachers and the public to learn about Earth from the unique perspective of space. At the core of the program is a spectacular collection of digital images of Earth. The image collection and accompanying learning guides and activities are extraordinary resources to support classes in Earth science, space science, geography, social studies, mathematics, communications and even art.

Using the World Wide Web, select middle schools can request images based upon their classroom investigations. Since the program's inception in 1996, the ISS EarthKAM camera has flown on five Space Shuttle flights and now resides on the International Space Station where it has taken thousands of pictures.

The EarthKAM collection of images provide opportunities to study:

- Specific Earth features (e.g. the nature of rivers, mountains, oceans, lakes, deserts, or coasts),
- Human-environment interactions (e.g. cities, agriculture, transportation),
- Weather (e.g. cloud patterns, conditions at extreme latitudes),
- Geoscience (e.g. interactions between human beings and their environment, natural and artificial boundaries, physical processes),
- Location specific studies (e.g. a specific city or country, comparing a place from the ground and from space),
- Technology (e.g. the effects of image processing, data transfers, tracking orbits and Shuttle/ISS positions) and Mathematics (e.g. scale comparisons; area and density calculations).

On the EarthKAM website (**<u>www.earthkam.ucsd.edu</u>**) you will find many resources to help you make use of EarthKAM images in your classroom. Including:

- Information on how to participate in ISS EarthKAM missions and take your own photographs of Earth.
- Educator guides and tutorials that support basic ISS EarthKAM image exploration skills, including using the datasystem, annotating images, locating images on maps, and more.
- Educator guides on planning and executing an in-depth investigation of ISS EarthKAM images.
- A lithograph set that provides educators with an excellent source of high quality images for use in the classroom. Each image has several thought-provoking questions to promote in depth investigation. The answers to these questions are also provided.

NASA Summer High School Apprenticeship Research Program (SHARP) (10-12)

Sponsored by NASA, SHARP celebrated its 25th anniversary in 2005. The program is designed to provide a hands-on research experience for students who have demonstrated a strong interest in and aptitude for science, technology, engineering and mathematics (STEM). Though the program is open to all students who meet the eligibility requirements, one of NASA SHARP's objectives is to encourage the career paths of pre-college students who have been traditionally underrepresented in STEM fields (Blacks or African Americans, American Indians or Alaska Natives, Native Hawaiians or other Pacific Islanders, Hispanics or Latinos, females and persons with disabilities).

Each year, approximately 400 students will be selected to participate in NASA SHARP for a minimum of eight weeks during the summer. Students will work with mentors on NASA-related content at NASA Field Installations and universities.

Students who are chosen for the program assist their mentors with some of their day-to-day tasks including conducting research, analyzing data, utilizing laboratory equipment, and developing technical applications. Students are required to participate in a variety of enrichment activities such as college fairs, financial aid seminars, and field trips to local industry and universities. In addition, they prepare written final reports and give oral presentations on their projects.

To become a participant in NASA SHARP, applicants must meet all of the following requirements by the start of the Program in June:

- Be a U.S. citizen or national who will be at least 16 years old by the time the Program starts.
- Demonstrate a strong interest in and aptitude for a career in science, technology, engineering and/or mathematics.
- Complete at least two mathematics courses and two science courses with an average grade of "B" or better in each course and an overall average of "B" or better in all other coursework.
- Communicate fluently in English.
- Participate in a formal interview if chosen as a finalist.
- Be available on a full-time basis (Monday through Friday, 40 hours per week) for the entire duration of the Program (usually from mid-June to mid-August).

The applications are generally due mid-February for the following summer.

For instructions on how to apply, visit the website: **http://www.nasasharp.com/**

Imagine Mars (4-8)

Below are two examples from the *Imagine Mars Project Participation Guide* to help you understand how Imagine Mars can encourage students to think creatively about their community and space exploration. The projects follow five steps:

Reflect...on what you value about your community
Imagine...a community on Mars
Discover...the planet you live on and the planet on which you will live
Create...a community for the 21st century
Share...your vision and ideas with the world.

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Example 1: Mr. Campbell's Fourth-Grade Class, Lincoln Elementary School

Lincoln Elementary, a large public school, has large classes but few textbooks and little equipment. Mr. Campbell wants his entire fourth-grade class to work on the Imagine Mars Project for an entire semester.

Reflect: Because there are more than 40 children in Mr. Campbell's class, he assigns them randomly to several Project Teams. Some Project Teams elect individuals to take all the notes while, in other groups, everyone does a little bit of everything. Mr. Campbell likes the latter arrangement best, but wants all of his Mission Specialists to learn how to work together.

Imagine: Students in Mr. Campbell's class learn about the vibrant big-city community around them by speaking with their neighbors and families. They also go to the library and research urban communities and the history of their cultures. They decide to name their community Springfield, after Lincoln's home, and imagine that it will be as vibrant and diverse as their community on Earth.

Discover: The Project Teams go to the library and study the environment on Earth and Mars and the challenges of bringing necessities such as food, water, and air to the fourth planet. Mr. Campbell invites a former NASA engineer to speak to his class about how long it would take to get to Mars and how much they could bring with them.

Create: While designing scientifically sound communities, the Project Teams create dances and songs that would be sent from Mars to Earth so that family and friends back on Earth could understand how their culture was evolving on Mars and, in turn, those families and friends could send back similar artistic works that could keep the new Mars community up to date on Earth culture.

Share: After submitting the registration forms for his class, Mr. Campbell takes his entire class to a city council meeting, where the Mission Specialists present their songs and dances from Springfield. There is a large celebration as members of the entire city view the student performance of their dances and songs.

From: http://imaginemars.jpl.nasa.gov/pdf/IMPPartGuide4_22.pdf, pgs 13 & 14

<u>Example 2</u>: Ms. Enriquez's Science Class and Mr. Kim's Art Class, The Zabriskie School (5-8)

The Zabriskie School is located in a rural community in America's Midwest. Students at the Zabriskie School are excited about using their brand-new computer lab to research and design their Mars community.

<u>Reflect</u>: Ms. Enriquez and Mr. Kim choose to have their classes work together as one Project Team so that each class member can learn about the other discipline. The classes get together and discuss what makes their community different—farming, raising livestock and crops, and the flat landscape.

<u>Imagine</u>: The students talk to their parents and grandparents and research the development of agriculture in their area. They also interview the nearby town's mayor and other civic leaders. They then use the Internet to learn about alternative crop management systems for arid climates like that on Mars. They study the art of American landscape painting and how it represents the wide open spaces in which their communities thrive.

<u>Discover</u>: The art class learns about 3-D modeling and takes field trips to galleries that feature space art and to other space-related locations, while the science class researches Mars using NASA's interactive Web materials and other Internet resources. They hold a conference call with an artist who paints landscapes of many different planets to understand how these landscapes differ from those they studied earlier.

<u>Create</u>: Once a week, the two classes meet and discuss what they have learned and what thoughts they have. At the end of the semester, the Project Team works together to build a 3-D model of the community and to write their one page essay about how they integrated ideas from space art, American landscape painting, and their own history to design the look and feel of their community.

<u>Share</u>: After turning in their Data Forms, the Project Team holds an event for the whole school and all the parents where they present their creation. Mr. Enriquez's class also enters their Mars community in the county science fair and wins first prize.

Photo courtesy of NASA

NASA Summer Programs and Workshops for Teachers

Educator Astronaut Program: Earth Crew (K-12)

Earth Crew is comprised of teams of students, teachers, and other adults that support Educator Astronauts before and during their missions. In addition, Earth Crew members also participate in ground-based projects and missions, including webcasts from space. Anyone with an email address can create an Earth Crew team, although kids under 13 must have an adult sponsor.

Website: **http://edspace.nasa.gov/earthcrew/**

Airspace Systems Education Cohort (ASEC) (K-12)

ASEC is a nationwide network of motivated and creative teacher-mentors who inspire the next generation of explorers as only NASA can. Mentors engage students and teachers with quality NASA multimedia products that support math and science education in the context of Aerospace Technology. Teachers may join this elite peer-mentoring network program by participating in a training program. Applications are due each year in March and it is a very competitive process Selected teachers attend an expenses-paid, 3-day institute at Ames Research Center in California to learn about new education and technology tools. Educators are encouraged to share their knowledge with teachers in their local community.

A teacher using ASEC tools in the Classroom
Photo courtesy of NASA

ASEC also holds workshops across the country to help educators learn new, interesting ways of presenting math, science, and technology material.

Website: **http://quest.arc.nasa.gov/projects/asec/**

NASA Astrobiology Institute Summer Workshops (5-12)

The NASA Astrobiology Institute helps fund numerous summer workshops across the country to provide teachers the newest ways to use NASA resources in the classroom, with a focus on astrobiology research and tools. Astrobiology is the study of life in the universe—its origin, evolution, distribution, and future. Scientific topics range from the examining the organic chemistry in interstellar clouds of gas and dust to the potential of life on Mars.

Website: **http://nai.arc.nasa.gov/teachers/index.cfm#workshops**