The Wright Way: Innovation Through Engineering

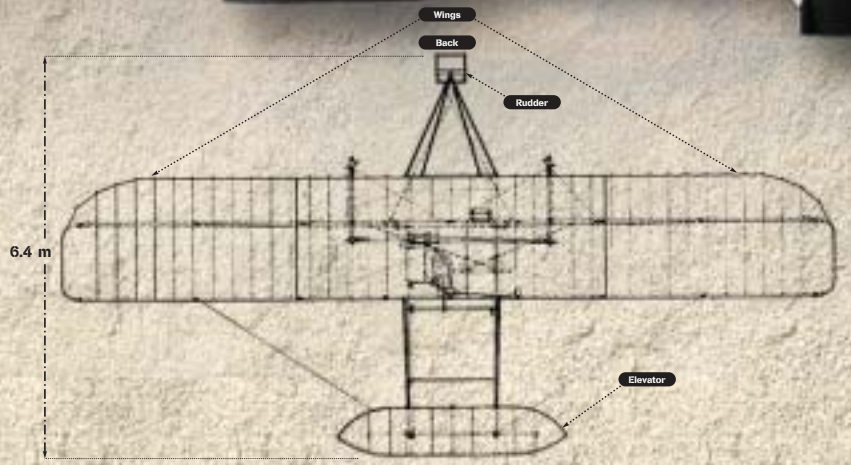
CENTENNIAL OF FLIGHT
1903-2003

North Carolina—First in Flight

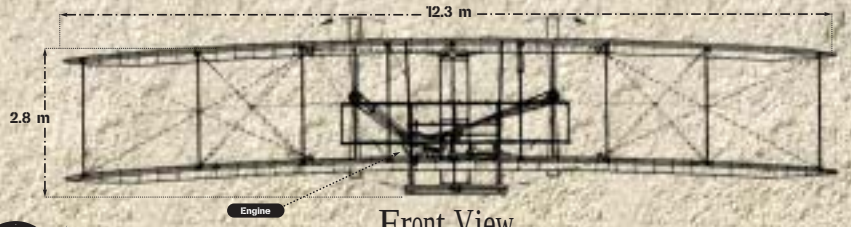
Kitty Hawk, NC

Orville Wright (1871-1948)

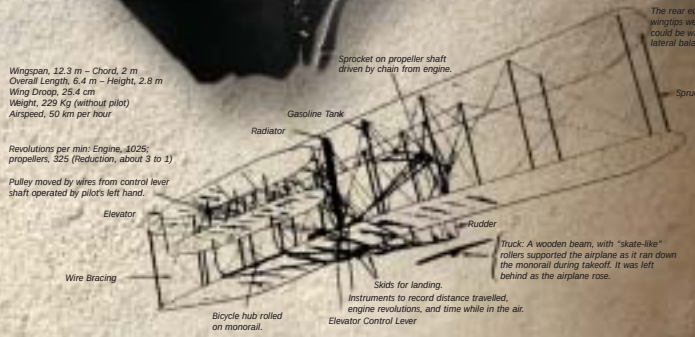
Wilbur Wright (1867-1912)

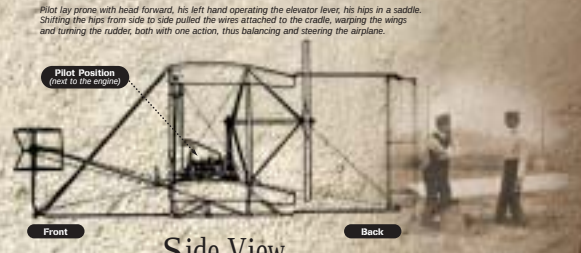


Top View



Front View





Side View

NASA
National Aeronautics and Space Administration

100th Anniversary of Powered Flight
1903-2003

www.centennialofflight.gov

Celebrating a Century of Powered Flight

The Wright brothers turned their dreams into reality and revolutionized the world.

ABOUT THE POSTER

This poster was designed to honor the accomplishments of the Wright brothers, two brilliant, self-trained engineers from Ohio who designed, built, and flew the first power-driven, heavier-than-air machine in which man made free, controlled, and sustained flight.

The historic event occurred on the morning of December 17, 1903, at a place known as Kill Devil Hills, four miles from the village of Kitty Hawk, NC. At about 10:35, the Wright brothers' machine began to move down a rail into a frigid wind that was gusting up to 37 meters per second. The airplane rose and fell for 12 seconds until it struck the sand approximately 37 meters from where it had become airborne. For the first time in history, an airplane had taken off, moved forward under its own power, and landed at a point at least as high as that from which it had started—all under the complete control of the pilot. The photograph of the first flight, depicted on the front of this poster, was taken just as the Wright brothers' machine left the rail. The Wright brothers alternately completed three additional flights that day, each farther than the one before.

The centennial of powered flight represents a unique opportunity to focus on the historical significance of the aviation-related events leading up to, and following, December 17, 1903. More importantly, the 100th anniversary of flight presents an opportunity to inspire a new generation of inventors, innovators, and dreamers. In the span of a single century, the vision, persistence, and ingenuity of many have taken us from the first powered flight on the sand dunes of North Carolina's outer banks to a permanent presence in space.

In honor of the 100th anniversary of flight, the U.S. Congress established the Centennial of Flight Commission. The Commission encourages, enables, and amplifies the efforts of all the organizations and individuals planning to celebrate the achievements of the Wright brothers and a century of powered flight by serving as a central resource and a catalyst for activities. The Commission is encouraging and promoting national and international participation in the commemoration of the centennial of powered flight by the public; educators and students; Federal, State, and local government officials; the military; members of civic and cultural organizations; and members of the aviation and aerospace industry.

We invite you to visit the U.S. Centennial of Flight Commission's Web site (***http://www.centennialofflight.gov***), where you will find a vast array of information about the history of aviation and aerospace. A few examples of what can be found on the site include a searchable calendar that features upcoming events related to aviation and aerospace with a "Submit an Event" button that allows event planners to post information. Essays can be found under the "History of Flight" section of the Web site. Under "For Educators and Students," you will find posters, a downloadable bookmark, and an Educational Resources Matrix with hundreds of aviation and aerospace-related education links. This is where you will be able to locate curriculum materials, information about workshops, scholarships, museums, and much more. Pictures, films, and special collections are located under the Sights and Sounds of Aviation category of the site. New materials are continuously being added to the site so be sure to visit often and check out "What's New."

The U.S. Centennial of Flight Commission has formed numerous partnerships in its quest to encourage and promote celebrations honoring the Wright brothers and others who have contributed to the history of aviation and aerospace. These organizations are listed at ***http://www.centennialofflight.gov/partners***

To the Educator

The purpose of this poster is to help you inspire, educate, and encourage your students to learn about the Wright brothers, the 100th anniversary of flight, and the history of aviation and aerospace. The activities are designed to provide hands-on experiences for your students that relate to some of the engineering processes that the Wright brothers and others used. All of the activities utilize the metric system and are related to the Principles and Standards for School Mathematics (***http://standards.nctm.org***) and the National Science Education Standards (***http://www.nap.edu/html/nses/html/***). The Standards for Technology Literacy from the International Technology Education Association (***http://www.iteawww.org/TAA/TAA.html***) are also a valuable measurement resource. As students, printers, and bicycle mechanics, Wilbur and Orville Wright used the traditional inch/pound system that is still the standard measurement system used in the United States today. However, during their flight tests in North Carolina, they measured wind speed in meters per second as opposed to miles per hour. As your students investigate how the Wright brothers solved the mysteries of mechanical flight, perhaps they will discover why. We hope that the information provided on this poster will help you teach your students about the metric system.

There are many additional sources of information listed on this poster. The "NASA Resources for Educators," the "Web Resources," and the "Extensions and Technology Connections" sections will help you and your students locate information, educational products, and activities related to the Wright brothers and the history of aviation and aeronautics.

A Few Questions To Get Your Students Started

The front of this poster includes an outline of the State of North Carolina whose motto is "First in Flight." How and why did two brothers from Ohio select this location for their first flight? How did they get there? How often did they go to North Carolina? How long did they stay? Where did they live? Where did they build their gliders and the 1903 airplane—North Carolina or Ohio? Were their machines transported from one State to the other, if so, how?

Why is the State of Ohio known as "The Birthplace of Aviation?" Where did the Wright brothers live in Ohio? What did they do there? How did they become interested in aviation?

Where else did the Wright brothers live? Besides North Carolina, where did the Wright brothers fly?

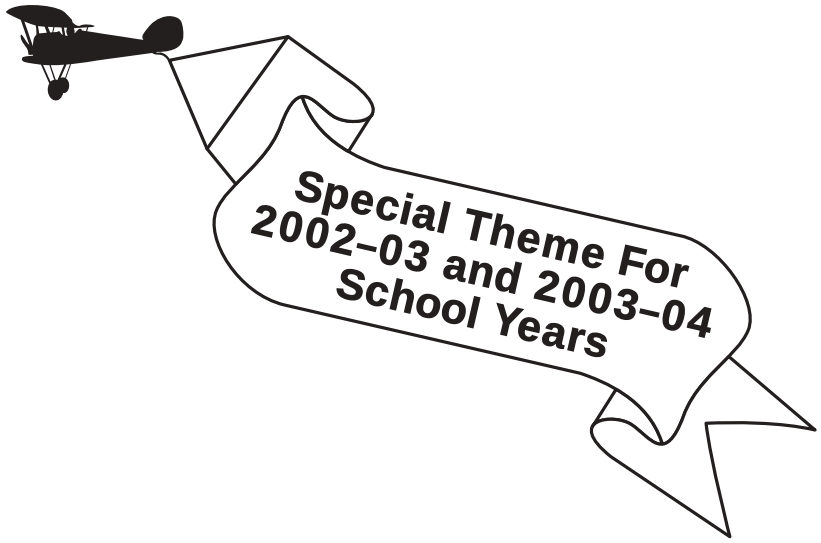
Although the States of North Carolina and Ohio are well known for early developments in aviation, many people from other States and countries around the world were thinking about flight, building aircraft, and conducting experiments before, during, and after the Wright brothers' involvement in flight. Who were these people? Where did they live? What contributions did they make?

Study your own State's aviation and aerospace history. Design a poster representing the history of aviation and aerospace in your State. Create a calendar with information about significant people, places, and historical aviation and aerospace events in your State. Share your poster and calendar with others in your school, community, or State. Send an electronic copy of your poster and your calendar to the Centennial of Flight Commission at ***centennialofflightadmin@hq.nasa.gov***. Plan your own centennial of flight celebration. If your event meets the criteria for inclusion on the Commission's calendar, complete and submit the electronic form found on the Calendar page of the Web site. Discuss how the advances in aviation and aerospace during the past 100 years have affected you and your family. Imagine what changes will occur in aviation and aerospace in the next 100 years.

The NASA Student Involvement Program (NSIP)

Science and Technology Journalism

Grades K–1: Class
Grades 2–4: Class or Teams of 2–4
Grades 5–12: Individuals or Teams of 2–4



The Wright Quest

Celebrate a century of flight!
Discover the past, invent the future!

Reflecting Upon the Adventures of Flight:
What happened on a cold windswept beach near Kitty Hawk, NC, on December 17, 1903? What were the events leading up to this milestone? How did this event change the world? Who are others who have or are exploring the fundamentals of flight? What are the benefits to our world? What is the future of aviation? What research is happening right now? Inventions? Can you predict future aviation milestones?

Learning Objectives:
Share scientific and technical achievements in a manner that is accurate, engaging, and informative—one that speaks to the inner spirit of exploration and discovery.

Procedure:
1. Develop a news report using one of the following media:
   - Print—An article with relevant photos, illustrations, or other graphics, laid out for publication.
   - VHS videotape—A 5-minute report in your choice of format (e.g., newscast, investigative or special report, or documentary).
2. Submit documentation about investigation and production methods.
3. Complete, sign, and send a) an entry form, b) an educator data form, and c) checklists.

Go to NASA for theme resources:
http://www.aerospace.nasa.gov/centuryofflight

Robert E. Lucas Intermediate School,
Cincinnati, OH

For complete details and to obtain an entry form, competition rules, checklist, judging rubric, and resource guide, please visit ***http://education.nasa.gov/nsip***.
Any questions? Send an e-mail to ***info@nsip.net*** or call 1-800-848-8429.

Sled Kite–Classroom Activity

Grades Preschool–5

The Wright brothers first built kites, then gliders, and finally a powered airplane.

tape

tape straw here

Objectives

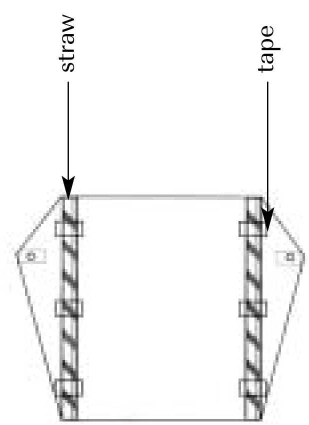
The student will 1) construct and fly a simple sled kite; 2) demonstrate how to make the kite fly at varying heights.

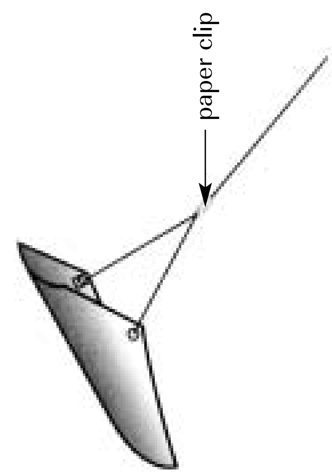
Activity Instructions

1. Make a copy of this Sled Kite Template. Carefully cut out the kite.
2. Decorate the top of the sled kite using crayons, markers, or other media.
3. Trim the length of the two drinking straws so they will fit in the area marked for the straws. Tape them in place.
4. Place two or three pieces of tape in the marked areas covering the black circles.
5. Using a single-hole paper puncher, carefully punch the two holes marked by the black circles.
6. Cut two pieces of kite string 45 cm each. Tie a string through each hole.
7. Tie the opposite end of both strings to a paper clip.
8. Tie one end of the 1 m long piece of string to the other end of the paper clip. Your sled kite is ready to fly!
9. Outside in a clear area, hold the 1 m length of string and run with the kite to make it fly.
10. Run slow and run fast, and observe how the kite flies at different towing speeds.
11. Record observations on the "Sled Kite Flying Journal" page.

Materials (per kite)

Sled Kite Template (black outline)
Two drinking straws
Tape
Scissors
Two 45 cm lengths of string
One 1 m length of string
Metric ruler
Single-hole paper puncher
One paper clip
Markers, crayons, pencils
Selection of paper (crepe, tissue, newspaper)





tape straw here

tape

Ask students to explain how their kites were built. Ask students to demonstrate ways to make kites fly higher and lower. Ask students to complete the Sled Kite Flying Journal.

From *Aeronautics: An Educator's Guide with Activities in Science, Mathematics, and Technology Education* EG-2002-06-105-HQ

Sled Kite Flying Journal

Date _____ Student's Name _____

Describe today's weather; include wind speed and direction. _____

_____

Predict what will happen with your Sled Kite under the following circumstances.

When you walk with your Sled Kite. _____

_____

When you run with your Sled Kite._____

_____

Describe what actually happened when you walked with your kite. _____

_____

Describe what happened when you ran with your kite. _____

_____

Predict what will happen to your kite if you add a tail. _____

_____

Describe how your kite flew with a tail. _____

_____

Conduct experiments by flying your kite with a longer tail and a shorter tail. _____

_____

Describe what happened when you flew your kite with a longer tail and a shorter tail. _____

_____

_____

Web Resources

Related Resources for Educators and Students:

U.S. Centennial of Flight Commission
http://www.centennialofflight.gov

NASA's Celebrating Flight Web Site—Investigations celebrating 100 years of flight: past, present and future!
http://spacelink.nasa.gov/celebratingflight

Re-Living the Wright Way—Information and links about how the Wright brothers used the process of invention to pave the way for powered flight.
http://wright.nasa.gov/

Information about the Early Wright Brothers' Flights
http://quest.nasa.gov/aero/wright/background/1899.html

NASAexplores—An online resource with express lessons for grades K–12.
http://www.nasaexplores.com/lessons/02-012/index.html

Links to Many Aerospace Activities, Resources, Online Opportunities and Careers
http://www.aerospace.nasa.gov/edu

Research the History of Spaceflight in the 20th Century
http://spacelink.nasa.gov/Instructional.Materials/Online.Educational.Activities/Century/index.html

Access Career, Information, and Instructional Resources from the National Society of Professional Engineers at
http://www.nspe.org

Information about the Metric System Can Be Found at the National Institute of Standards and Technology
http://www.nist.gov

NASA Science™ (NASA SCI) Files™ series of Emmy-award-winning, science-based, instructional programs introduces students in grades 3–5 to NASA and integrates mathematics, science, and technology through the use of Problem-Based Learning (PBL), scientific inquiry, and the scientific method. Emphasizing standards-based instruction, each program in the series has three components: a 60-minute television broadcast (divided into four, 15-minute segments), an educator's guide, and an interactive Web site featuring a PBL activity that enables students to further explore topics presented in the broadcast. The Web site also contains a wealth of instructional resources. More information about the NASA Science Files is available from ***http://scifiles.larc.nasa.gov/treehouse.html***

NASA CONNECT™ is a series of 30-minute, Emmy-award-winning, instructional mathematics programs for grades 6–8. Emphasizing standards-based instruction, this series seeks to establish a connection between the mathematics, science, and technology concepts taught in the classroom and those same concepts used every day by NASA researchers. Each program in the series has three components: a 30-minute television broadcast; a lesson guide which includes a hands-on activity that reinforces and extends the objectives presented in the program and establishes a connection between the math, science, and technology taught in the classroom; and an interactive Web activity which provides educators with the opportunity to integrate technology in the classroom. More information about NASA CONNECT is available from ***http://connect.larc.nasa.gov***

First Flights—Classroom Activities

Grades 6–12

Objective: Students will analyze and interpret data from the four flight trials of the Wright brothers on December 17, 1903, and use communication skills to write explanations of the events.

Activity A Procedure:

1. Use the data below and calculate the average speed of each flight trial.

Speed = Distance/Time			
Flight	Distance (meters)	Time (seconds)	Average Speed (m/sec)
1	37	12	_____
2	53	12	_____
3	61	15	_____
4	260	59	_____

2. Make a graph comparing the average speeds of the four trials. What factors might have influenced the flight of the plane and caused such different speeds?

3. Analyze the graph of "Speed vs. Time" below. Identify the events that occurred in sections A, B, and C of the graph. Write a paragraph about what happened during the flight.

Extensions:

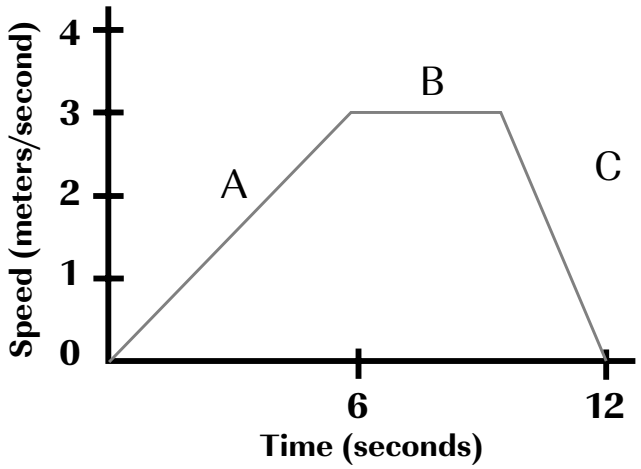
- The wind speed at Kitty Hawk that day was up to 12 meters/second and the speed of the machine over the ground against the wind was 3.05 meters/second. What would have been the speed of the machine in calm air? How far would it have traveled during the first flight with calm winds?

- The flight speeds were not as constant as the data might indicate. Instead, there were control problems and erratic speeds. Find out how the Wright brothers solved these problems in later airplane designs.

- Depending on the experience of your students, use the graph "Speed vs. Time" as a model to create a graph that shows the changes in acceleration of the Wright Flyer during the flight.

The graph below represents a mathematical model of how the Wright brothers' first flight may have happened.

SPEED vs. TIME



Activity B Procedure:

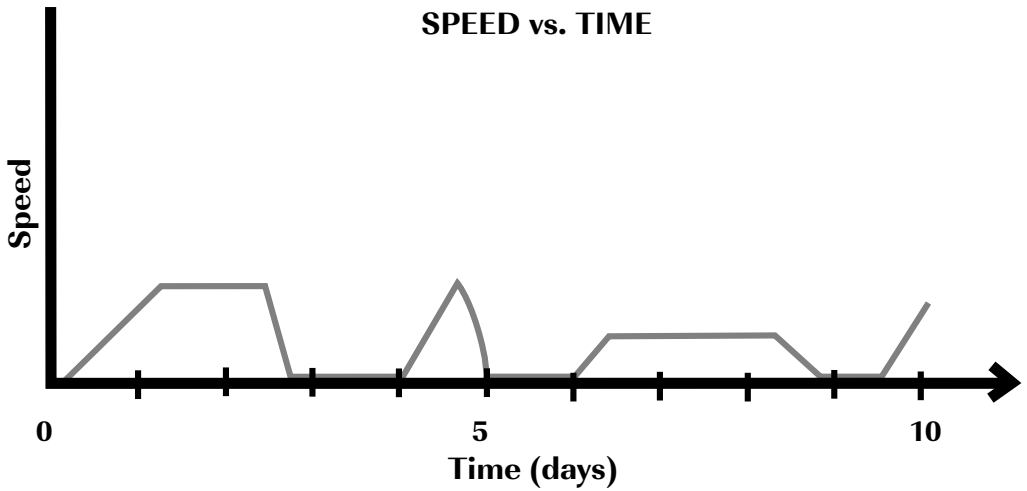
The Vin Fiz™ was a Wright brothers Model EX airplane built in response to a Hearst prize of $50,000 to be given to the first person to fly across the United States in 30 days.

Below is a "mathematical model" of the flight that took place in 1911 when pioneer aviator "Cal" Rodgers attempted a coast-to-coast, 30-day journey in this Wright EX airplane. Unfortunately his flight took 49 days and was plagued by many problems, which included crashes when he collided with trees, chicken coops, and other obstacles. He replaced numerous parts of his plane during the 70 stops along the way, but managed to keep the Nation's interest focused on flying.

1. Using this "mathematical model" of "Cal" Rodgers' flight in the Vin Fiz™*, write a story about the first 10 days of Rodgers' trip. Research the various speeds of his plane, the events that took place between days 3, 4, and 5 and explain why the shapes of the "mathematical model" changed.

2. Present the story to the class using the "mathematical model" as a visual aid.

3. Create a graph of the entire flight.



*TM 2000 Vin Fiz is a registered trademark of Inventing Flight: Dayton 2003.

Extensions and Technology Connections:

Measurement of All Things: Tools of the Aeronautics Trade
http://connect.larc.nasa.gov/pdf/measure.tools.guides.pdf

Aerodynamics Problem Sets for High School Mathematics Courses
http://www.lerc.nasa.gov/WWW/K-12/BGA/BGAindex.html

The Flight of the Vin Fiz Flyer: The First Crossing of America by Air
http://aerofiles.com/vinfiz.html

First Flight Data Activities for Grades 5–8 from NASA Explores
http://www.nasaexplores.com/lessons/01-081/5-8_2.pdf

Exploring Aeronautics CD-ROM (Grades 5–8)
An interactive exploration of how airplanes work, and how NASA tests them
http://catalog.core.nasa.gov/core.nsf/item/400.0-91

Earth to Orbit: Engineering Design Challenges Curriculum Supplement (Grades 6–9)
Use specially prepared activity guides to investigate NASA engineering challenges
http://eto.nasa.gov

Flight Testing Newton's Laws CD-ROM, Videos, Educator Guide (Grades 9–12)
Fly with NASA test pilots and perform research with NASA engineers with this interactive multimedia package
http://trc.dfrc.nasa.gov/trc/ntps

Virtual Skies Web Site (Grades 9–12)
Students use NASA air traffic management techniques to make real-life decisions in aeronautics, geography, mathematics and meteorology
http://quest.nasa.gov/aero/virtual

The Wright Flyer: Practice Makes Perfect—Activities for Grades 9–12
http://www.nasaexplores.com/lessons/01-081/9-12_index.html

Beginner's Guide to Aeronautics Online
http://www.grc.nasa.gov/WWW/K-12/airplane/bga.html

Aerospace-Related Activities, Experiments, and Lesson Plans
http://www.lerc.nasa.gov/WWW/K-12/aeroact.htm

NASA Resources for Educators

NASA's Central Operation of Resources for Educators (CORE) was established for the national and international distribution of NASA-produced educational materials in multimedia format. Educators can obtain a catalogue and an order form by one of the following methods:

NASA CORE
Lorain County Joint Vocational School
15181 Route 58 South
Oberlin, OH 44074-9799
Phone: (440) 775-1400
FAX: (440) 775-1460
E-mail: *nasaco@leeca.org*
Home Page: *http://core.nasa.gov*

Educator Resource Center Network (ERCN)
To make additional information available to the education community, NASA has created the NASA Educator Resource Center (ERC) network. Educators may preview, copy, or receive NASA materials at these sites. Phone calls are welcome if you are unable to visit the ERC that serves your geographic area. A list of the centers and the regions they serve includes the following:

AK, Northern CA, HI, ID, MT, NV, OR, UT, WA, WY
NASA Educator Resource Center
NASA Ames Research Center
Mail Stop 253-2
Moffett Field, CA 94035-1000
Phone: (650) 604-3574
http://amesnews.arc.nasa.gov/erc/erchome.html

IL, IN, MI, MN, OH, WI
NASA Educator Resource Center
NASA Glenn Research Center
Mail Stop 8-1
21000 Brookpark Road
Cleveland, OH 44135
Phone: (216) 433-2017
http://www.grc.nasa.gov/WWW/PAO/html/edteachr.htm

CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT
NASA Educator Resource Laboratory
NASA Goddard Space Flight Center
Mail Code 130.3
Greenbelt, MD 20771-0001
Phone: (301) 286-8570
http://www.gsfc.nasa.gov/vc/erc.htm

CO, KS, NE, NM, ND, OK, SD, TX
Space Center Houston
NASA Educator Resource Center for **NASA Johnson Space Center**
1601 NASA Road One
Houston, TX 77058
Phone: (281) 244-2129
http://www.spacecenter.org/educator_resource.html

FL, GA, PR, VI
NASA Educator Resource Center
NASA Kennedy Space Center
Mail Code ERC
Kennedy Space Center, FL 32899
Phone: (321) 867-4090
http://www-pao.ksc.nasa.gov/kscpao/educate/edu.htm

KY, NC, SC, VA, WV
Virginia Air & Space Center
NASA Educator Resource Center for **NASA Langley Research Center**
600 Settlers Landing Road
Hampton, VA 23669-4033
Phone: (757) 727-0900 x 757
http://www.vasc.org/erc/

AL, AR, IA, LA, MO, TN
U.S. Space and Rocket Center
NASA Educator Resource Center for **NASA Marshall Space Flight Center**
One Tranquility Base
Huntsville, AL 35807
Phone: (256) 544-5812
http://erc.msfc.nasa.gov

MS
NASA Educator Resource Center
NASA Stennis Space Center
Mail Stop 1200
Stennis Space Center,
MS 39529-6000
Phone: (228) 688-3338
http://education.ssc.nasa.gov/erc/erc.htm

CA
NASA Educator Resource Center for **NASA Jet Propulsion Laboratory**
Village at Indian Hill
1460 East Holt Avenue, Suite 20
Pomona, CA 91767
Phone: (909) 397-4420
http://learn.jpl.nasa.gov/resources/resources_index.html

AZ and Southern CA
NASA Educator Resource Center **NASA Dryden Flight Research Center**
PO Box 273 M/S 4839
Edwards, CA 93523-0273
Phone: (661) 276-5009
http://www.dfrc.nasa.gov/trc/ERC/

VA's and MD's Eastern Shores
NASA Educator Resource Center for **GSFC/Wallops Flight Facility**
Visitor Center Building J-17
Wallops Island, VA 23337
Phone: (757) 824-2298
http://www.wff.nasa.gov/~WVC/ERC.htm

Regional Educator Resource Centers offer more educators access to NASA educational materials. NASA has formed partnerships with universities, museums, and other educational institutions to serve as regional ERCs in many states. A complete list of regional ERCs is available through CORE, or electronically via NASA Spacelink at *http://spacelink.nasa.gov/ercn*

NASA's Education Home Page serves as the education portal for information regarding education programs and services offered by NASA for the American education community. This high-level directory of information provides specific details and points of contact for all of NASA's educational efforts, Field Center offices, and points of presence within each State. Visit this resource at the following address: *http://education.nasa.gov*

NASA Spacelink is one of NASA's electronic resources specifically developed for the education community. Spacelink serves as an electronic library to NASA's educational and scientific resources, with hundreds of subject areas arranged in a manner familiar to educators. Using Spacelink Search, educators and students can easily find information among NASA's thousands of Internet resources. Special events, missions, and intriguing NASA Web sites are featured in Spacelink's "Hot Topics" and "Cool Picks" areas. Spacelink may be accessed at *http://spacelink.nasa.gov*

NASA Spacelink is the official home to electronic versions of NASA's Educational Products. A complete listing of NASA Educational Products can be found at the following address: *http://spacelink.nasa.gov/products*

NASA Television (NTV) features Space Station and Shuttle mission coverage, live special events, interactive educational live shows, electronic field trips, aviation and space news, and historical NASA footage. Programming has a 3-hour block—Video (News) File, NASA Gallery, and Education File—beginning at noon Eastern and repeated four more times throughout the day. Live feeds preempt regularly scheduled programming.

Check the Internet for programs listings at *http://www.nasa.gov/ntv*
For more information on NTV, contact
NASA TV
NASA Headquarters–Code P-2
Washington, DC 20546-0001
Phone (202) 358-3572

NTV Weekday Programming Schedules (Eastern Times)

Video File	*NASA Gallery*	*Education File*
12–1 p.m.	1–2 p.m.	2–3 p.m.
3–4 p.m.	4–5 p.m.	5–6 p.m.
6–7 p.m.	7–8 p.m.	8–9 p.m.
9–10 p.m.	10–11 p.m.	11–12 p.m.
12–1 a.m.	1–2 a.m.	2–3 a.m.

How to Access Information on NASA's Education Program, Materials, and Services (EP-2002-07-345-HQ)
This brochure serves as a guide to accessing a variety of NASA materials and services for educators. Copies are available through the ERC network, or electronically via NASA Spacelink.

EW-2002-08-137-HQ
The Wright Way: Innovation Through Engineering
Please take a moment to evaluate this product at
https://ehb2.gsfc.nasa.gov/edcats/educational_wallsheet
Your evaluation and suggestions are vital to continually improving NASA educational materials. Thank you.