National Aeronautics and Space Administration
Langley Research Center

Educator's Guide	
Teachers & Students	Grades 4-8

A Series of Five Satellite (Television & Internet) Broadcasts

NASA con²ect

Program 4 in the 1998-1999 Series

RECIPES FOR THE FUTURE...

Publication Number
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1998-1999 NASA CONNECT Program Overview

INTRODUCTION TO THE NASA CONNECT SERIES

NASA CONNECT is an award-winning instructional series produced by the NASA Langley Research Center's Office of Education (Hampton, VA). The series links the national mathematics and science standards to aeronautics and demonstrates the application of the standards through electronic visits by satellite and the Internet to the NASA workplace. Students engage in real or near real-time interactions with researchers and are exposed to innovative research, along with the tools and methods being used to conduct the research. The target audience is students in grades 4-8.

Each program in the NASA CONNECT series consists of a 30-minute instructional television broadcast accompanied by a web-based component designed to complement and extend the video and to facilitate the connection between the classroom and home. Inquiry into authentic questions is a central strategy used to "hook" the students into actively participating in the program and using the web components. Connections between mathematics and science concepts taught in the classroom and the workplace are emphasized.

Learning in a meaningful context is important for all students. Many television and web activities within the NASA CONNECT series are linked to form in-depth investigations that can be used in flexible ways. The investigations can be complete replacement units for parts of the present school curriculum or blended with other sources to give students explanations of ideas or practice with skills that are introduced or used in basal texts. Full integration of the series teaching protocol allows for active student participation in activities, group work, data gathering, student discourse, and journal writing. The activities and investigations in NASA CONNECT will prove useful in helping upper elementary and middle school students learn mathematics and science.

The 1998-99 NASA CONNECT program season uses aeronautics and space technology (AST) as its organizing theme. This theme will form the context to create interesting programs by featuring research questions that arise out of NASA's research. The theme addresses NASA's goals for AST that are grouped into three areas or "Three Pillars": *Global Civil Aviation*, *Revolutionary Technology Leaps*, and *Access to Space*. These goals reflect national priorities for the NASA Aero-Space Technology Enterprise and require taking risks and performing the long-term research and development programs needed to keep the United States the global leader in aeronautics and space.

ABOUT THIS LESSON - RECIPES FOR THE FUTURE

The fourth program in the series, *Recipes For The Future,* focuses on the physical properties of materials, mixtures, and compounds. Students are introduced to the various measuring and testing techniques used to develop "composite" materials for airplanes and space vehicles. NASA researchers will show students how recipes for the future begin with the identification of requirements, the selection of proper ingredients, and the application of proper processing, fabrication, and analysis procedures. Students will conduct an experiment designed to investigate the strength and maximum deflection of a composite material with and without the use of a reinforcer. *Recipes for the Future* program partners and contributors include WVEC Channel 13, New Millennium Studios, Johnson & Wales University College of Culinary Arts, Chesapeake Bagel Bakery, NASA Langley Research Center, and NASA Marshall Space Flight Center.

PROGRAM FORMAT

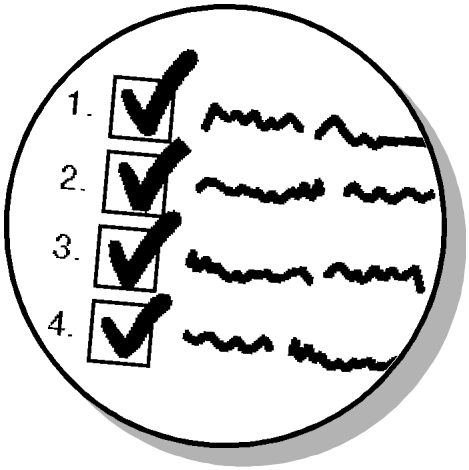
Each NASA CONNECT program includes the following:

- **NASA Guest**: The program features program partners and a NASA engineer, scientist, or technician to illustrate the application of classroom lessons to the workplace.
- **Activities**: Students are involved in hands-on activities drawn from NASA educational products, including the National Council of Teachers of Mathematics (NCTM) math activity books, *Mission Mathematics*, developed in collaboration with NASA.
- **Students**: Middle school students who have conducted the program's experiment are highlighted. The results of their experiment are shared with viewers.
- **Challenge Point**: The programs include a pause period in the flow of the program, in which students are presented with data and, working in pairs or small groups, are encouraged to perform analysis and data interpretation.
- **Call-In/E-mail**: Students can call in following the Challenge Point portion of the program with questions related to the program topic, the activity, or the guest. Students can also e-mail questions one week prior to and two weeks following the live broadcast.
- **Print Materials**: Print materials are provided for registered educators. The materials include background on the program content and the featured activity, as well as a master copy of the Student Challenge Point Worksheets for copying and distribution to students. Also outlined is a teaching protocol for the implementation of the featured program activity and web investigation.
- **Web Site**: Throughout the program, the NASA CONNECT URL (http://edu.larc.nasa.gov/connect) will be displayed to indicate points where further details and/or interactive activities relating to the video presentation can be examined.

WEB FORMAT

The broadcast and the Internet are closely interwoven in the NASA CONNECT series. The series uses the Internet in several ways to enhance the teaching and learning process.

- **Inquiry Instruction**: Students are provided with questions and investigations that require them to discover the generalities of the subject on the basis of practice examples. Feedback and elaboration are provided. Students gain new insight by making observations, developing inferences, making comparisons, and interpreting data.
- **Home Connection**: Parents are encouraged to be partners in the explorations and activities. The web site provides a means for the parent and child to share in the learning process. Educators are encouraged to make parents aware of the web site and to encourage this one-on-one discovery between the parent and child about the mathematics and science concepts.
- **Internet Simulcast**: Each NASA CONNECT program is simulcast in real time through the Internet. Educators are encouraged to check NASA's Learning Technologies Channel (http://quest.arc.nasa.gov/ltc/special/connect) schedule for further details on technology requirements and the broadcast schedule.
- **Registration and Feedback**: Educators can register on-line for NASA CONNECT, can obtain broadcast schedule information for their state, can download print materials, and can evaluate the program through the NASA CONNECT web site (http://edu.larc.nasa.gov/connect).



NCTM* MATHEMATICS STANDARDS

- Problem Solving
- Number Sense and Numeration
- Patterns and Relationships
- Statistics
- Measurement
- Algebraic Equations

NCTM ASSESSMENT STANDARDS

- Talking and writing about predictions and interpretation of data help students confirm their learning
- Observing which students can use a data-collections form and which students need to learn how
- Engaging students in tasks that involve problem solving, reasoning, and communication

NSTA† SCIENCE STANDARDS

- Science as Inquiry
- Science and Technology
- Physical Science

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* National Council of Teachers of Mathematics
† National Science Teachers Association

NASA CONNECT MATRIX

The following matrix should help teachers organize the concepts from the *Recipes For The Future* program that complement each other (for better instruction). Teachers are encouraged to further extend and add to this matrix after viewing the program and reviewing their curriculum.

Math Standards	Science as Inquiry	Science & Technology
Measurement	Measure distances and weights Set up the experiment parameters	NASA researchers illustrate the importance of accurate measurements in developing new materials
Number Operations	Calculate flex strength	
Data Analysis	Collect data Keep Records	NASA researchers explain the different types of tests performed and the analyses of the tests
Problem Solving	Determine the strength of a material with and without a reinforcement Engage in mathematical discourse to extend understanding of problem solving and capacity to reason and communicate mathematically	NASA researchers describe the systematic approach taken when developing new materials and fabrication processes Technologies provide tools for investigations, inquiry, and analysis

NASA CONNECT Teaching Protocol

There is a definite difference between "doing science" and doing science activities. Educators have few opportunities to work with scientists to develop an understanding of the nature of scientific inquiry. The model proposed to educators through the NASA CONNECT series is a shift from "activitymania" – a collection of hands-on activities that are often disconnected from each other – to inquiry, in order to introduce students to the process of searching for patterns and relationships and to better develop their higher order cognitive skills. Below is a six-step teaching protocol designed to prepare students for more active mental engagement to the video program so that they can make stronger connections between the NASA CONNECT program activities and appropriate mathematics and scientific concepts.

The six-step protocol includes reflective discussion, video engagement, dialogue notes, NASA CONNECT activity, journal writing, and NASA CONNECT web. This protocol is consistent with constructivist theory. A learning environment that promotes rich discourse among students is central to the approach. Student teams that engage in discovery, decision making, and problem solving give students opportunities to develop and present their findings to the entire class. The proposed format is flexible and is an effective way to teach students complex math and science concepts, to model science inquiry, and to emphasize connections.

STEP 1: REFLECTIVE DISCUSSION

Before viewing the NASA CONNECT program, list on the chalkboard the following questions to help students form their own theories and to give them a place to start constructing their knowledge about the show's topic. Have students share their thoughts or write their responses. Keep these questions on the board during the video. In addition to helping students prepare for the video, these questions can also serve as a pretest for assessment purposes.

1. How can math and science help us when we are following and preparing a recipe?
2. What types of science-related jobs might require preparing recipes and mixtures?
3. How would you describe the relationship between science and technology?
4. What role do mathematics and mathematical tools play in scientific inquiry?
5. What value might collaborations and partnerships have in conducting research?

STEP 2: VIDEO ENGAGEMENT

1. *Recipe Card Notes:* Students observe the NASA CONNECT hosts preparing and improving a cookie recipe. NASA researchers use scientific steps to "cook up" their aerospace materials. The adult host will interview the researchers to discover whether their methods will help with the cookie recipe. Teachers should copy the Recipe Card Notes from page 7 and distribute them prior to the video showing. Encourage students to take careful recipe notes during the video interviews with NASA researchers.
2. *Challenge Point:* Students work in cooperative groups to respond to the video's Challenge Point segment. During the Challenge Point, students see data from an experiment and have a short time to respond to questions related to the data. The Student Challenge Point Worksheet is on page 9**.** Teachers should copy and distribute the worksheet to students prior to the Challenge Point. One calculator per student group is also recommended.
3. *Call-In/E-Mail Opportunity:* Students can call and ask the NASA CONNECT guests questions during the call-in segment. E-mail questions can also be submitted for response one week before and two weeks following the live broadcast.

   Call in with questions (accepted during the live broadcast only) at
   Toll Free 1-888-835-0026 Local 864-3991

   E-mail questions (one week before and two weeks following the live broadcast date) to connect@edu.larc.nasa.gov

STEP 3: DIALOGUE NOTES

1. Immediately after the video, students should spend five to ten minutes reviewing the questions in the Step 1: Reflective Discussion section (page 5). Ask students to give examples from the video presentation that support their responses to each question.
2. Review the Recipe Card Notes (page 7) with students. Ask students to share what they recorded and learned from each researcher. Discuss the math and science concepts that students believe are important in the work performed by each researcher.
3. Return to the Student Challenge Point Worksheet (page 9) and, if necessary, provide students with additional time to complete the mathematical calculations and the data analysis. Challenge students to think of different kinds of investigations that can be created from the experiment.

STEP 4: NASA CONNECT ACTIVITY

Students learn from direct teaching, engaging in classroom discussion, conducting research, and taking notes. During the NASA CONNECT video, an experiment is described. This activity is provided for the educator to use as a math/science lab. When using the NASA CONNECT Activity (page 10), introduce students to the vocabulary, guide students toward connections, and explore misconceptions. Class data from the experiment can then be compared with the data collected by the students and highlighted in the video. Have students relate their lab experiment to the NASA research discussed in the video.

STEP 5: JOURNAL WRITING

Journal writing supports students' reflective thinking processes. Students should reflect on what they learned from the video and from their own experimentation. Educators can also ask students questions that relate to the real-life applications of the concepts in the video and their lab experiment. Educators might use journal questions to assess student understanding of the concepts at all levels of comprehension.

STEP 6: NASA CONNECT WEB

The web site uses the inquisitory instruction strategy to place students in a contextual environment to encourage them to discover the math and science concepts and skills behind the program's topic and to present multiple perspectives to specific questions raised in the video. An on-line experiment or series of activities is incorporated into the NASA CONNECT web site for each program to augment the video theme and to provide additional opportunities for students to perform multiple trials and share their data with others. Also, from the web site, students might submit E-mail questions to the on-air program guests up to two weeks following a live broadcast.

Educators might use this site to provide a connection between the classroom and home, such as sending home a notice about the NASA CONNECT program and its Internet URL and by encouraging parents to explore this site and complete the activities with their children.

The web site for *Recipes For The Future* contains two on-line activities. The first activity, "The Secret Formula," will help students gain insight into the inventiveness and systematic approach applied towards the development and testing of a new product. In the web site activity, students will become product scientists at a toothpaste factory. They will create a toothpaste formula, try to calculate the production cost, and learn to determine product pricing for their new brand of toothpaste.

A second activity posted under the *Recipes For The Future* web site is the "Career Site." This activity is designed to present students with an opportunity to explore some of the technical and professional career options associated with structures and materials research at the NASA Langley Research Center, Hampton, VA. Students can browse through a series of short questions that focus on how NASA researchers work as teams to develop and test new materials that will make airplanes and space vehicles safer and more efficient to operate. The "expert" responses highlight how members of a research team work together to solve problems. The web page features color pictures of researchers in their labs, with their responses to questions in both text and sound.

Recipe Card Notes

(Use this sheet in connection with the cookie recipe segment seen on the videotape)

Cook's Name _____

Recipe Card Note: _____

_____

_____

_____

_____

Cook's Name _____

Recipe Card Note: _____

_____

_____

_____

_____

Cook's Name _____

Recipe Card Note: _____

_____

_____

_____

_____

Built within the program's design is a pause period (approximately four minutes long) in which students will be asked to look at generated data and, working in pairs or small groups, respond to questions, one at a time, as listed on the Student Challenge Point Worksheet (page 9). This pause period is important for providing students the opportunity to work with information presented up to this point and to actively examine and work with data in support of the NCTM standards.

During the Challenge Point Period

Teacher as Facilitator

1. Depending on the students, teachers may wish to have a large group or to divide students into pairs or smaller groups. This grouping should be done before the program.
2. The teacher should act as a facilitator during this program time, supporting and guiding the students in discussion and in responding to the worksheet questions.

Student as Researcher

By working in pairs or small groups, students will better understand how NASA research teams work together to analyze and interpret findings and to communicate results in written, oral, and graph forms.

1. Observe the data shown on the television, as displayed on the Student Challenge Point Worksheet. The data were recorded by the featured school.
2. Questions pertaining to the data will be presented one at a time on the videotape. Students will have a limited amount of time to discuss the question with their partner(s), calculate an answer, if necessary, and write down a response.
3. Feedback to the questions will be presented at the end of the Challenge Point period. Review the answers. Following the program, continue the discussions, if necessary.

Student Challenge Point Worksheet

(Use this sheet during the paused segments on the videotape)

Flex Strength Data		
Poster Board Specimen	*Load (N)	*Flex Strength (MPa)
2 sheets	3.0	6.2
2 sheets with epoxy	11.1	15.1
2 sheets with epoxy and fiberglass	14.9	18.2

Challenge Point Questions:

1. Based on the data presented, which specimen has the highest flex strength? Why?

_____

_____

_____

2. Based on the data presented, which specimen has the lowest flex strength? Why?

_____

_____

_____

3. Why is there such a big difference between the flex strengths of specimens 1 and 2?

_____

_____

_____

* N = Newtons MPa = Mega Pascals

NASA CONNECT Activity

Students working in teams will test the flex strength of a material with and without the use of a reinforcer such as epoxy. There are three materials available for testing.

EXPERIMENT MATERIAL

6 pieces of 7.5 cm wide by 15 cm long standard poster board
Popsicle sticks
Quick-drying epoxy
One small sheet of fiberglass
String
One empty 1-gallon milk jug
Measuring cup
Water
Measuring scale
Ruler
Tape

VOCABULARY TERMS

Atoms - the smallest part of an element that can exist.

Composite - a combination of two or more materials whose properties are different from its original form, or individual components when the two materials are combined. Examples include bricks made of straw and mud, concrete made from rock and cement, and materials made from fiberglass and epoxy.

Fiber - a long, thin strand of material like nylon, hair, wood, or even glass

Flex Strength - the resistance by a material to the maximum load before failure by bending.

Molecule - the smallest unit of matter which can exist by itself and, still retain all the properties of the original substance.

Polymer - a large molecule built up by the repetition of small, simple chemical units. Examples are nylon, polyester, teflon®, and rubber.

Stiffness - the ratio of a steady force acting on a body to the corresponding change in length.

Stress Cracks - external or internal cracks in a plastic caused by the application of forces to the body within the environment to which it is exposed.

BEFORE THE ACTIVITY

1. Check the materials list.
2. Review the vocabulary.
3. Make copies of the Student Challenge Point Worksheet (page 9).
4. Divide the students into teams. Student (S)1 is the Chief Chemist, who prepares the base materials and chemical binder. S2 is the Composite Engineer, who handles and prepares the fiberglass and rigs the test apparatus. S3 is the Test Engineer, who calculates the flex strength of the material. S4 is the analyst, who records the data and handles the report.

NASA CONNECT Activity Continued...

STEP 1: CLASS REFLECTION/JOURNAL

List the following questions on the board. Have the students discuss the questions.

1. What common human-made composite material do you walk on everyday? (concrete)
2. Why are composites used in industry? (for strength and reduction in size or weight needed)
3. What types of composites are now being used in items such as golf clubs and stealth fighter planes? (carbon-graphite and resin)
4. Which composites are used in such things as boats, skateboards, surfboards, portable toilets? (fiberglass plus plastic epoxy or polyester resins)
5. What are some disadvantages of composite materials? (cost, difficult to repair, rigidity differences)

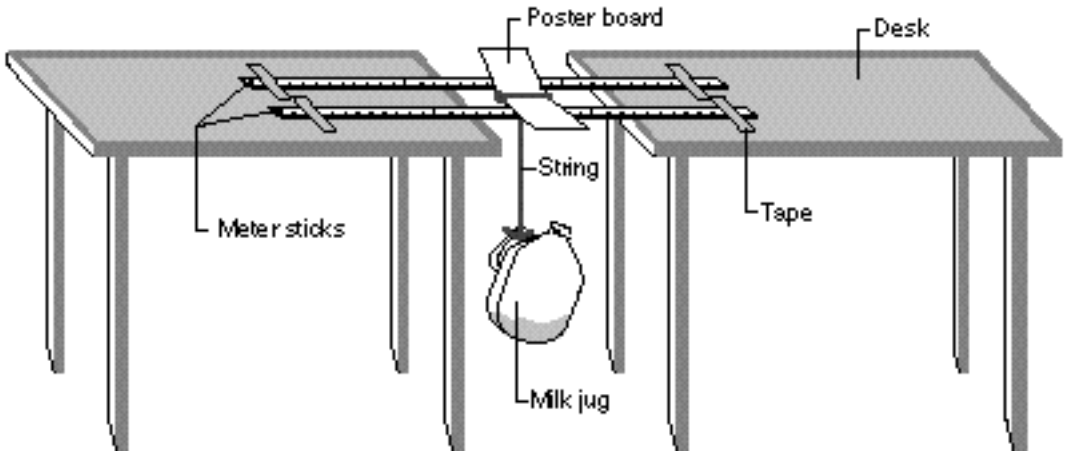
STEP 2: THE NASA CONNECT ACTIVITY

(Students and teachers do not have to determine the thickness of specimens. The data table on page 13 specifies the thickness of the material.)

Follow these directions to complete the experiment:

1. Carefully cut out six pieces of poster board 7.5 cm wide by 15 cm long.
2. Set the two pieces aside to be used without any reinforcement or binder. Two pieces will be used with an epoxy compound and two with epoxy and a sheet of fiberglass.
3. For the epoxy board, put on the rubber gloves and squeeze out enough of the 2-part epoxy to make a pool about the size of a quarter on the back of the poster board. Mix thoroughly with a popsicle stick.
4. Spread the epoxy evenly over the surface of the first poster board.
5. Take the second poster board and press the two pieces together.
6. Place a book on top of specimen and put it aside to dry.
7. Mix a new batch of epoxy as before.
8. Spread the epoxy on one side of the board with a popsicle stick and lay the piece of fiberglass on top of the epoxy. Smooth the fiberglass with the popsicle stick to remove as many air bubbles as you can. The epoxy should now be oozing through the fiberglass.
9. Lay the second piece of poster board on top of the fiberglass and press them together to form a "sandwich."
10. Place a book on top of specimen and let this composite material dry.
11. Take two flat meter sticks and have them bridge a space between two desks. Using a ruler, measure the sticks 6 cm apart so that they will support the poster board. Be sure there is enough distance between the desks to allow for a milk jug to hang freely.
12. Tape the meter sticks onto the desks. **(See drawing on page 12.)**
13. Take two of the dry pieces of poster board and place them over the meter-sticks.
14. Tie one of the strings onto the milk jug handle. Form the other end of the string into a loop big enough to slide over the lengthwise part of the poster board. Be sure to measure enough string so that the milk jug will dangle 5 cm above the floor. The distance from the floor is our MAXIMUM DEFLECTION and is a design requirement of this experiment.
15. Take the loop of string and slide it over the poster board. Set the board over the meter sticks.
16. Let the milk jug hang down gently. Make sure the specimen lies flat.
17. Carefully pour water into the jug until the test material bends enough to send the jug to the floor.
18. Pick up the water-filled jug and the string and place them on the scale to determine how much weight caused the poster board to bend or "flex."
19. Repeat the same test with the epoxy poster board, and the fiberglass poster board.

NASA CONNECT Activity Continued...



20. Record the data on the NASA Connect Activity Student Record Sheet (page 13). Calculate the flex strength using the formula.

$$\text{Flex strength} = \frac{1.5\ (\text{Load})\ (\text{Span})}{(\text{Width})\ (\text{Thickness})^2}$$

Load = weight of water-filled jug plus string
Width = width of specimen
Thickness = thickness of specimen (see NASA Connect Activity Students Record Sheet (pg. 13)
Span = distance between meter sticks supporting specimen

21. Compare data with other teams.

STEP 3: DIALOGUE NOTES

Students should review their observations and data and then respond to these questions in their logs. Consider the research effort underway by NASA to develop and improve composite technology.

1. Which sample had the lowest flex strength?
2. Which sample had the highest flex strength?
3. Teachers can help students calculate the percent of difference between the two poster board sheets and the fiberglass composite material that has a reinforcer.

STEP 4: JOURNAL WRITING

Students are able to reflect further on the experiment through their journal writing

1. What might the results be if you doubled the layer? Tripled it?
2. Where do you think composites will show up more often in the future?
3. What might the result be if you used sand instead of water?
4. What would happen if you increased the “span” supporting the specimen?
5. What happens if air is not removed from the composite specimen?

STEP 5: ELECTRONIC EXTENSION

1. Divide students into small groups. Have each group check out the *Recipes For The Future* web site and complete the on-line investigation. (http://edu.larc.nasa.gov/connect)
2. Inform parents about the web site and invite them to explore this site with their children.

NASA Connect Activity Student Record Sheet

Group Members: _____

Poster Board Specimen	Thickness of Specimen in Meters	Thickness^2 of Specimen in Meters	Width of Specimen in Meters	Span Between Sticks in Meters	Load Applied in Milk Jug in Pounds	*Load in Newtons
Two Sheets	0.000762					
Two Sheets with Epoxy	0.0009398					
Two Sheets with Epoxy & Fiberglass	0.0009906					

Figure the Flex strength for each of the specimens above, using the formula below:

$$\text{Flex strength (MPa)} = \frac{1.5\ (\text{Load in Newtons})\ (\text{Span in meters})}{(\text{Width in meters})\ (\text{Thickness in meters})^2}$$

1. 2 sheets:

2. 2 sheets with epoxy:

3. 2 sheets with epoxy and fiberglass:

* The conversion factor for pounds to Newtons is 1 lb = 4.45 Newtons

NASA Connect Activity Teacher's Reference Guide

Poster Board Specimen	Thickness of Specimen in Meters	Thickness^2 of Specimen in Meters	Width of Specimen in Meters	Span Between Sticks in Meters	Load Applied in Milk Jug in Pounds	*Load in Newtons 1 lb=4.45N
Two Sheets	0.000762	5.81×10^{-7}	0.076	0.061	0.068	3.0
Two Sheets with Epoxy	0.0009398	8.83×10^{-7}	0.076	0.061	2.50	11.1
Two Sheets with Epoxy & Fiberglass	0.0009906	9.81×10^{-7}	0.076	0.061	3.34	14.9

Figure the Flex strength for each of the specimens above, using the formula below:

$$\text{Flex strength (MPa)} = \frac{1.5\ (\text{Load in Newtons})\ (\text{Span in meters})}{(\text{Width in meters})\ (\text{Thickness in meters})^2}$$

1M N/m^2 = Pa

(sample calculation)

1. 2 sheets: $= \dfrac{1.5\ (3.0\ \text{N})\ (0.061\text{m})}{(0.0762\ \text{m})\ (0.000762\ \text{m})^2} = 6.2 \times 10^6\ \text{N/m}^2 =$ **6.2 MPa**

2. 2 sheets with epoxy: **15.1 MPa**

3. 2 sheets with epoxy and fiberglass: **18.2 MPa**

* The conversion factor for pounds to Newtons is: 1 lb = 4.45 Newtons

NASA Aeronautics Educator Resources

The NASAAero-Space Technology (AST) Enterprise and educational communities are partners in developing materials to stimulate student interest and enthusiasm for science and mathematics. By augmenting learning environments with ideas and experiences that use mathematics and science, we share with students and educators the excitement of how these tools can be used and how their power can change the world.

NASA ON-LINE AERONAUTICS PROJECTS

Follow these on-line links to more aeronautics-related projects that provide curriculum, interactive materials, activities, and more, as developed by the NASA AST Centers and Learning Technologies Project (LTP) Offices and by external partners through LTP-funded electronic projects!

Aeronautics and Aviation Science Careers and Opportunities (Massachusetts Corporation for Educational Telecommunications)	http://mcet.edu/nasa
Aeronautics Learning Laboratory for Science, Technology and Research (ALL STAR) (Florida International University)	http://allstar.fiu.edu/aero
Internet-based Curriculum on Math and Aeronautics for Children with Physical Disabilities (InfoUse, Inc.)	http://planemath.com/
K-8 Aeronautics Internet Textbook (Cislunar Aerospace, Inc.)	http://wings.ucdavis.edu/
Kids Corner (NASA Langley)	http://kidscorner.larc.nasa.gov/
Lego Data Acquisition and Prototyping System (Tufts University)	http://ldaps.ivv.nasa.gov/
NASAAeronautics Enterprise Web Ground School (NASA Headquarters)	http://www.hq.nasa.gov/office/aero/edu/
Sharing NASA (NASAAmes)	http://quest.arc.nasa.gov
Wright Flyer Online (NASAAmes)	http://quest.arc.nasa.gov/aero/wright/

NASA ON-LINE RESOURCES FOR EDUCATORS

NASA Spacelink (http://spacelink.nasa.gov) is one of NASA's electronic resources specifically developed for use by the education community. This comprehensive electronic library offers teacher guides, wall sheets, and listings of videos, computer software, and other materials that have been developed to meet national education standards. Educators can search specific curriculum materials by grade level and subject matter. Current and historical information related to NASA's aeronautic and space research can be found from Spacelink. Links to other NASA resources, news releases, current state reports on agency projects and events, and television broadcast schedules for NASA Television are also given. Finally, a contact list of NASA Educator Resource Centers is located in most states, and the Central Operation of Resources for Educators (CORE) is available through NASA Spacelink.

Quest (http://quest.arc.nasa.gov) is the home of NASA's K-12 Internet Initiative. The electronic resource specializes in providing programs, materials, and opportunities for teachers and students to use NASA resources as learning tools to explore the Internet. One of its unique projects is "Sharing NASA," a series about on-line, interactive units where students can communicate with NASA scientists and researchers to experience the excitement of real science in real time. During the 1998-99 academic year, Aero Design Team On-line will be a featured project of "Sharing NASA."

Learning Technologies Channel (LTC) (http://quest.arc.nasa.gov/ltc/) is a NASA location on the Internet that allows you to participate in on-line courses and to remotely attend some NASA workshops and seminars. A primary focus of the LTC is to broaden the uses of the Internet to include in-service teacher training and to bring new Internet experiences into the classroom.

NASA CENTRAL OPERATION OF RESOURCES FOR EDUCATORS (CORE)

NASA's CORE is a worldwide distribution center for NASA multimedia educational materials. Educational materials include videotape programs, slide sets, and computer software. For a minimal fee, NASA CORE will provide educators with materials through its mail order service. A free NASA CORE catalog is available.

NASA CORE
15181 State Route 58
Oberlin, OH 44074-9799
phone: (440) 774-1051, ext. 249 or 293
fax: (440) 774-2144
E-mail: nasaco@leeca.esu.k12.oh.us
URL: http://spacelink.nasa.gov/CORE

NASA EDUCATIONAL PROGRAMS AND MATERIALS

The widest possible distribution and use of NASA educational programs and materials is encouraged. Specifically, there is no claim of copyright by the U.S. Government concerning the NASA CONNECT series. Therefore, permission is not required to either tape each broadcast or to copy the associated print materials for classroom use and/or retention in your school's library.

NASA EDUCATOR RESOURCE CENTERS (ERC)

The NASA ERC Network is composed of Educator Resource Centers located at or near all NASA installations and ERCs located at planetariums, universities, museums, and other nonprofit organizations nationwide. These centers supply instructional activities, videotapes, slides, and computer software generated by NASA programs, technologies, and discoveries. These materials are designed for educators of all disciplines and are aligned to the national education standards.

For more information on NASA education programs and aeronautics-related materials, educators may contact the following NASA Centers' ERCs. The NASA installations that have the lead research programs in the NASAAero-Space Technology (AST) Enterprise are underlined:

AK, AZ, CA, HI, ID, MT, NV, OR, UT, WA, WY
NASA Ames Educator Resource Center
Mail Stop 253-2
Moffett Field, CA 94035-1000
(650) 604-3574

CA cities near the center
NASA Dryden Educator Resource Center
45108 North Third Street East
Lancaster, CA 93535
(805) 948-7347

CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT
NASA Goddard Educator Resource Center
Mail Code 130.3
Greenbelt, MD 20771-0001
(301) 286-8570

CO, KS, NE, NM, ND, OK, SD, TX
NASA Johnson Educator Resource Center
Mail Code AP2
2101 NASA Road One
Houston, TX 77058-3696
(281) 483-8696

NASA JPL Educator Resource Center
Mail Stop 601-107
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-8080 - fax

FL, GA, PR, VI
NASA Kennedy Educator Resource Center
Mail Code ERL
Kennedy Space Center, FL 32899-0001
(407) 867-4090

KY, NC, SC, VA, WV
NASA Langley Educator Resource Center
Virginia Air and Space Center
600 Settlers Landing Road
Hampton, VA 23669-4033
(757) 727-0900, ext. 757

IL, IN, MI, MN, OH, WI
NASA Lewis Educator Resource Center
Mail Stop 8-1
21000 Brookpark Road
Cleveland, OH 44135-3191

AL, AR, IA, LA, MO, TN
NASA Marshall Educator Resource Center
U.S. Space and Rocket Center
P.O. Box 070015
Huntsville, AL 35807-7015
(205) 544-5812

MS
NASA Stennis Educator Resource Center
Building 1200
Stennis Space Center, MS 39539-6000
(601) 688-3338

VA's and MD's Eastern Shore
NASA Wallops Educator Resource Center
Education Complex - Visitor Center
Building J-1
Wallops Island, VA 23337-5099
(757) 824-2297/2298

Return by Fax to: (757) 864-8835

1998-99 NASA CONNECT Series Program Evaluation

About the Program

1. The program was used (please check)
   a. to introduce a curriculum topic, objective, or skill. ❑ Yes ❑ No
   b. to reinforce a curriculum topic, objective, or skill. ❑ Yes ❑ No
   c. as a special interest topic. ❑ Yes ❑ No
   d. other (please specify)_____

2. The program was viewed ❑ Live ❑ Videotaped

3. Indicate the grade level(s) that viewed the program: ❑ 4 ❑ 5 ❑ 6 ❑ 7 ❑ 8
   Other (please specify) _____

The Program's Value

Please circle the number that best reflects your opinion.

	Strongly Disagree				Strongly Agree	No Opinion
4. The program met its stated objectives.	1	2	3	4	5	0
5. The program's content was developmentally appropriate for grade level.	1	2	3	4	5	0
6. The program's content was aligned with the National Math and Science Standards.	1	2	3	4	5	0
7. The program's content was easily integrated into the curriculum.	1	2	3	4	5	0
8. The program's content enhanced the teaching of math and science.	1	2	3	4	5	0
9. The program raised student awareness of careers that require math and science knowledge.	1	2	3	4	5	0
10. The program presented:						
a. the application of math and science on the job.	1	2	3	4	5	0
b. workplace science as a collaborative process.	1	2	3	4	5	0
c. science as a process requiring creativity, critical thinking, and problem-solving skills.	1	2	3	4	5	0
11. The technical aspects of the video production were professional.	1	2	3	4	5	0
12. The program's web-based component enhanced student interest in learning math and science.	1	2	3	4	5	0

The Lesson Guide/Classroom Activity's Value

13. The Lesson Guide was complete.	1	2	3	4	5	0
14. The Lesson Guide was easily understood.	1	2	3	4	5	0
15. The classroom activity (experiment) was developmentally appropriate for grade level.	1	2	3	4	5	0

Overall Evaluation

16. The program was a valuable instructional opportunity.	1	2	3	4	5	0

Please record any comments or suggestions on an additional sheet of paper and fax with this form.

Evaluator's Characteristics

17. Gender: ❑ Female ❑ Male

18. Ethnicity: ❑ African American ❑ Asian ❑ Caucasian
    ❑ Hispanic ❑ Native American ❑ Pacific Islander
    ❑ Other (please specify) _____

19. Highest Degree attained
    ❑ Baccalaureate/BA or BS
    ❑ Master's/Master's Equivalency
    ❑ Doctorate

20. Total years' teaching experience _____