

DOCUMENT RESUME

ED 130 909

SE 021 651

AUTHOR Geist, John E.  
 TITLE Space and Its Problems. [Aids to Individualize the Teaching of Science, Mini-Course Units for Grades 7, 8, and 9.]  
 INSTITUTION Frederick County Board of Education, Md.  
 PUB DATE 73  
 NOTE 18p.; For related Mini-Course Units, see SE 021 624-656; Not available in hard copy due to marginal legibility of original document  
 AVAILABLE FROM Frederick County Board of Education, 115 East Church St., Frederick, MD 21701 (no price quoted)  
 EDRS PRICE MF-\$0.83 Plus Postage. HC Not Available from EDRS.  
 DESCRIPTORS \*Aerospace Education; Individualized Instruction; Instructional Materials; Junior High School Students; Process Education; \*Science Education; Science Materials; Secondary Education; \*Secondary School Science; \*Space Sciences  
 IDENTIFIERS Maryland (Frederick County); Minicourses

ABSTRACT

This booklet, one of a series developed by the Frederick County Board of Education, Frederick, Maryland, provides an instruction module for an individualized or flexible approach to 7th, 8th, and 9th grade science teaching. Subjects and activities in this series of booklets are designed to supplement a basic curriculum or to form a total curriculum, and relate to practical process oriented science instruction rather than theory or module building. Included in each booklet is a student section with an introduction, performance objectives, and science activities which can be performed individually or as a class, and a teacher section containing notes on the science activities, resource lists, and references. This booklet presents an introduction to the study of space, rockets, and space flight. The estimated time for completing the activities in this module is 2-3 weeks. (SL)

\*\*\*\*\*  
 \* Documents acquired by ERIC include many informal unpublished \*  
 \* materials not available from other sources. ERIC makes every effort \*  
 \* to obtain the best copy available. Nevertheless, items of marginal \*  
 \* reproducibility are often encountered and this affects the quality \*  
 \* of the microfiche and hardcopy reproductions ERIC makes available \*  
 \* via the ERIC Document Reproduction Service (EDRS). EDRS is not \*  
 \* responsible for the quality of the original document. Reproductions \*  
 \* supplied by EDRS are the best that can be made from the original. \*  
 \*\*\*\*\*

U S DEPARTMENT OF HEALTH,  
EDUCATION & WELFARE  
NATIONAL INSTITUTE OF  
EDUCATION

THIS DOCUMENT HAS BEEN REPRO-  
DUCEO EXACTLY AS RECEIVED FROM  
THE PERSON OR ORGANIZATION ORIGIN-  
ATING IT. POINTS OF VIEW OR OPINIONS  
STATED DO NOT NECESSARILY REPRESENT  
OFFICIAL NATIONAL INSTITUTE OF  
EDUCATION POSITION OR POLICY.

# AIDS TO INDIVIDUALIZE THE TEACHING OF SCIENCE

ED130909

PERMISSION TO REPRODUCE THIS COPY  
AND THE MATERIAL HAS BEEN GRANTED BY

Marvin G. Spencer

TELETYPE AND OPERATIONAL OPERATIONS  
IN COOPERATION WITH THE NATIONAL IN-  
STITUTE OF EDUCATION. FURTHER REPRO-  
DUCTION OUTSIDE THE ERIC SYSTEM RE-  
QUIRES PERMISSION OF THE COPYRIGHT  
OWNER.

## MINI-COURSE UNITS

BOARD OF EDUCATION OF FREDERICK COUNTY

**1973**

Frederick County Board of Education

Mini Courses for  
Life, Earth, and Physical Sciences  
Grades 7, 8, and 9

Committee Members

Life Science	-	Terrence Best Paul Cook Sharon Sheffield Melvin Whitfield
Earth Science	-	Nelson Ford John Fradiska John Geist
Physical Science	-	Ross Foltz Kenneth Howard Fred Meyers

Dr. Alfred Thackston, Jr.  
Assistant Superintendent for Instruction

Marvin Spencer  
Science Supervisor

Frederick, Maryland

1973

## FOREWORD

The contents represented in these modules of instruction, called mini courses, is an indication of our sincere desire to provide a more individualized and flexible approach to the teaching of science.

Data was accumulated during the school year relative to topics in life, earth, and physical science that were felt to be of greatest benefit to students. The final selection of topics for the development of these courses during the workshop was made from this information.

It is my hope that these short courses will be a vital aid in providing a more interesting and relevant science program for all middle and junior high school students.

Dr. Alfred Thackston, Jr.  
Assistant Superintendent for Instruction

## ACKNOWLEDGEMENTS

Mrs. Judy Fogle, Typist  
Miss Patti Lockard, Typist  
Mr. Victor Gosnell, Printing Assistant  
Mrs. Helen Shaffer, Printing Technician  
Mr. Darl Hinkle and Staff, Instructional Materials Center

Frederick County Board of Education  
Frederick, Maryland

Mr. G. Hunter Bowers, Jr.  
President

Mr. Frederick L. Smith, Vice President  
Mrs. Frances W. Ashbury  
Mr. William B. Barnes

Mr. Clement E. Gardiner  
Mrs. Mary Condon Hodgson  
Mrs. Doty Remsberg

Dr. John L. Carnochan, Jr.  
Superintendent of Schools

Copyright 1973

Frederick County Board of Education

# SPACE AND ITS PROBLEMS

Prepared by

John E. Geist

## CONTENTS

### Student Section (white pages)

Introduction

General Objectives

Topics

- I. When Did it All Begin?
- II. Why is Space a Problem?
- III. How Do We Get to Space?
- IV. They Said We Would Never  
Put a Man in Space!
- V. Out of Sight! What's That?
- VI. What's Next?

### Teacher Section (blue pages)

Resources

Quiz

Lab

Estimated Teaching Time

2-3 weeks

## SPACE AND ITS PROBLEMS

## INTRODUCTION:

It is interesting to note that the study of space and rockets began many, many years ago. Actually, it began when man first looked up at the night sky. You might be wondering who the first people were and who launched the first rockets, or how did America's space program develop? The nature of the space environment is ..., well, what is it like? Why does it cause so many, many problems for man? Can you list some of these problems? Which one would you consider the most important? Why?

Controlled flight began with the first airplane; however, something much more powerful was needed to escape from earth's gravity. Thus you can understand why scientists designed rockets. What is a rocket? What makes them go? Why were different kinds of rockets built? What is multi-staged rockets? In discovering the answers to these questions, you will find that there have been many manned and unmanned space flights and moon landings. Do you understand the goals of these missions? Can you name our first astronaut and the first man ever to set foot on the moon?

Some people say that we're living in the "space era". Some people said man would never land on the moon. Now that men have been there, you should be wondering what's next? What planet will be explored next? What will future space craft look like? Let's see what we can learn about this space age we are living in.

## GENERAL OBJECTIVES FOR THIS UNIT:

After completing this unit you will have a(an):

1. better understanding of space, rockets, and the man in space program.
2. appreciation for the pioneers in space exploration and rocketry.
3. desire to keep informed about future space flights.

## TOPICS:

## I. When Did it all Begin?

## A. Objectives

Students will:

1. identify and explain the first rocket launchings.
2. list pioneers and their contributions to the space program.
3. identify the major developments in space exploration.

## B. Activities

1. Reading assignments: use one or more texts to help complete the above objectives.

Pathways Book 3, Unit IV, Chapter 1

Earth Science: The World We Live In, 1965, Chapter 26, p. 365  
1969, Chapter 28, p. 426

Modern Earth Science, 1969, Chapter 1, p. 2

The Earth, Its Changing Form, 1970, Chapter 20, pp. 520-523.

2. View film: Story of Space Age: Dr. Goddard to Project Gemini
3. Research: Write a report on one of the topics listed below. You may do another one and it will count extra credit.
  - a. Dr. Goddard
  - b. Wan Hu (1500's)
  - c. Hot air or gas balloons
  - d. Wright Brothers or Kitty Hawk
  - e. Germany's V-2 rocket
  - f. I.G.Y. space probes
  - g. Sputnik I
4. Construct a time-line tracing the major events which occurred as space exploration developed.

## II. Why is Space a Problem?

### A. Objectives

Students will:

1. describe the nature of the space environment.
2. identify and list some medical problems man encounters in space.
3. identify and list some mechanical problems man encounters in space.

### B. Activities

1. Reading Assignment: use one or more texts to help complete the above objectives.

Pathways Book 3, Unit IV, Chapter 2

Earth Science: The World We Live In, 1965, Chapt. 26, pp. 376-378 & 365-372  
1969, Chapt. 28, pp. 438-440 & 426-434

Modern Earth Science, 1969, Chapter 5, pp.108-110

2. Do experiments 4 and 5 in Rockets (obtain from the teacher).
3. Observe: Filmloop titled Experimental Weightlessness

or

Filmstrip: Conditions in Space, Space Flight, Part 1, Physical Problems  
Space Flight, Part 2, Human Problems

or

Study Prints: Building toward the Moon

or

Film: Gravity, Weight and Weightlessness, F559

4. Research: Write a report on one of the following topics. You may do another one and it will count extra credit.
  - a. weightlessness
  - b. vacuum
  - c. g-forces
  - d. Newton
  - e. eating food in space
  - f. materials for construction of space crafts
  - g. excursion 7-2 in Silver Burdette's Environmental Science, ISCS

### III. How Do We Get to Space?

#### A. Objectives

Students will:

1. explain the action and reaction principle.
2. distinguish between a solid fuel and liquid fuel propulsion system.
3. describe the launch site complex (identify features and structures).
4. explain the launch from countdown to splashdown.

#### B. Activities

1. Experiment with a balloon. Explain why it goes when you blow it up and let go.
2. Do experiment 2 in Rockets.
3. Construct a diagram (and label it) of the solid fuel chamber and the liquid fuel chamber. (Use a text or recommended study print.)
4. List and describe features at the launch site complex. (Use text or recommended study print.)
5. Observe study prints titled Countdown to Splashdown and explain the sequence of events during a launch.
6. Reading assignment: use one or more texts to help complete the above objectives.

Pathways Book 3, Unit 4, Chapters 3-4

Earth Science: The World We Live In, 1965, Chap. 26, p. 366, 372-374  
1969; Chap. 28, p. 427, 434-436

Modern Earth Science, 1969, Chapter 5, pp. 98-100

The Earth: Its Changing Form, 1970, Chapter 20, pp. 520-523

7. Research: Write a report on one of the following topics. You may do another one for extra credit.
  - a. Assembly of a rocket at Cape Kennedy
  - b. Saturn V rocket (include a diagram)
  - c. Staging
  - d. Assemble and launch your own rocket (see Estes catalogue)
  - e. Thrust

### IV. They Said We Would Never Put a Man in Space!

#### A. Objectives

Students will:

1. name the pioneer astronauts.
2. identify the major manned space programs.
3. construct a diagram and explain the most important steps in a manned trip to the moon and back.
4. explain the astronauts preparation for the space flights.

#### B. Activities

1. Reading assignment: use one or more texts to help in completing the above objectives.

Pathways Book 3, Unit 4, Chapter 5

Earth Science: The World We Live In, 1965, Chapt. 26, pp. 379-384  
1969, Chapt. 28, pp. 442-443

Modern Earth Science, 1969, Chapter 5

The Earth: Its Changing Form, 1970, Chapter 21

2. Observe transparencies from the set titled "Space Travel"  
or  
study prints from the set titled "Space Travel"  
or  
film: Eagle has Landed: Apollo 11, F846
3. Filmstrip: Man in Space or Man's Preparation for Space Travel
4. Use of study print titled "Astronauts - Training and Equipment"
5. Research: Write a report on one of the following topics. You may do another one for extra credit.
  - a. Food preparation for the astronauts
  - b. The space suit
  - c. The Rover
  - d. Personality of individual astronauts
  - e. Psychology of being in space

V. Out of Sight! What's That?

A. Objectives

Students will:

1. list the purposes of orbiting unmanned satellites.
2. identify common satellites with their programs.
3. diagram and explain the orbits of satellites.

B. Activities

1. Reading assignment

Pathways Book 3, Unit 4, Chapter 5

Earth Science: The World We Live In, 1965, Chapt. 26, pp. 378-379  
1969, Chapt. 28, pp. 441-443

Modern Earth Science, 1969, Chapter 5

The Earth: Its Changing Form, Chapter 20, pp. 537-544

2. Use transparencies from set titled "Space Travel"  
or  
filmstrip titled "Information from Satellites"  
or  
film: Space Satellites
3. Work lab - Orbiting of a Man-made Satellite (obtain lab pages from your teacher)
4. Research: Write a report on one of the following topics. You may do another for extra credit.
  - a. Echo I
  - b. Tiros
  - c. Vanguard I
  - d. Sputnik I
  - e. Solar cells
  - f. Where satellites are made
  - g. Nimbus
  - h. Orbiting astronomical observatory

## VI. What's Next?

### A. Objectives

Students will:

1. identify several future space missions and explain their goals.
2. design a futuristic spacecraft or space station.
3. compose or tell a short story about traveling in space.

### B. Activities

1. Read "Space Shuttle" by NASA.
2. Write to NASA for information on this topic.
3. Research one of these topics
  - a. Sky Lab
  - b. Space stations
4. Design a spacecraft or space station.
5. Contest idea: See who can compose the most original space story.

All of the audio-visuals are available at the IMC. It is suggested that the teacher evaluate and use these materials when he feels they are most appropriate. Other materials are available at the IMC.

This unit was modified for use with several earth science texts; however, other books do have chapters which can be used with these objectives in mind. Included are two folders which are used. You may wish to order some of these. Also included here is a copy of the lab titled, "Orbiting a Man-made Satellite". Short class discussions following each section of this course are recommended.

A sample quiz is provided for your use; however, it is suggested that the teacher determine his evaluation.

Resources:

Pathways, Book 3 by Globe Publishing Company, 1970

Earth Science: The World We Live In, by Namowitz and Stone, Van Nostrand Company, 1965 and 1969

Modern Earth Science, by Ramsey and Buckley, Holt, Rinehart & Winston Co., 1969

The Earth: Its Changing Form, by Brandwein, et al, Harcourt, Brace Jovanovich Co., 1970

## Quiz on Space Travel

Name \_\_\_\_\_

Period \_\_\_\_\_

Match the satellite with its mission.

- |               |       |  |
|---------------|-------|--|
| 1. Sputnik I  | _____ | A. First American satellite; 1958; Discovered Van Allen radiation belt |
| 2. Sputnik II | _____ | B. Will orbit earth for centuries, solar powered                       |
| 3. Explorer I | _____ | C. Provides communications for vessels at sea                          |
| 4. Vanguard I | _____ | D. First man-made satellite (Russian)                                  |
| 5. Pioneer    | _____ | E. First to return to earth intact                                     |
| 6. Discoverer | _____ | F. First satellite to carry a living thing                             |
| 7. Tiros      | _____ | G. Explores the planets  |
| 8. Comsat     | _____ | H. Orbits the sun and radios information to earth about outer space    |
| 9. Transit    | _____ | I. Photographs the moon's surface                                      |
| 10. Ranger    | _____ | J. Communications satellite  |
| 11. Mariner   | _____ | K. Weather satellite, photographs clouds                               |
|               |       | L. Two-manned mission to the moon                                      |

Match the definition with the correct term.

- |  |   |
|--|---|
| _____ 12. Newton's law, which explains rocket thrust.  | A. friction   |
| _____ 13. The shape of a man-made satellite's orbit.   | B. multi-stage rocket                                       |
| _____ 14. Air resistance   | C. apogee   |
| _____ 15. weightlessness   | D. satellite  |
| _____ 16. needed to put satellites into orbit.   | E. ellipse  |
| _____ 17. A body in space revolving around another body.   | F. condition of Og's  |
| _____ 18. A force which counteracts inertia to keep a body traveling in orbit rather than in a straight line out into space. | G. gravity  |
| _____ 19. part of an orbit farthest from the earth.  | H. for every action there is an equal and opposite reaction |
| _____ 20. used to slow down a rocket or to change its direction.   | I. perigee  |
|  | J. retrorockets   |
|  | K. spacecraft   |

**LAB: ORBIT OF A MAN-MADE SATELLITE**

**Purpose:** To construct a diagram that will help us to understand some important features of satellite orbits.

**Background:** The orbits of man-made earth satellites, like the orbits of the natural moons, planets, and comets of the solar system, are elliptical. As such, their distances from the earth and speed of revolution change steadily through each revolution around the earth. The point at which the satellite approaches closest to the earth is its **perigee** (*peri*, near, *gee*, earth). The point at which the satellite is farthest from the earth is its **apogee** (*apo*, away). These words are comparable to the words **perihelion** and **aphelion** used in connection with orbits around the sun.

In this exercise we shall construct and study a scale diagram of the orbits of **Vanguard I**, **Echo I** (the balloon satellite), and **Satellite X** (an imaginary satellite with a circular orbit).

**Materials:** 1) Unlined white paper, 8 1/2 x 11" 2) ruler 3) compass

Approximate Distances of Satellite from Earth's Surface				
Name	Apogee		Perigee	
	Miles	Inches*	Miles	Inches*
Vanguard I	2500		400	
Echo I	1200		1000	
Satellite X	4000		4000	

\*Scale: 1/4 inch = 500 miles.

**PROCEDURE**

**The Earth**

1) Using a scale of 1 inch to 2000 miles (1/4 inch = 500 miles), describe a circle at the center of your paper to represent the earth. Assume a radius of 4000 miles for the earth. Place arrows at left and right sides of the earth to show its counterclockwise rotation.

**The Sun**

2) Hold the paper with long edge from left to right. At the left edge, draw horizontal arrows 2 inches long and 1 inch apart, (starting at the center of the edge) to represent sun's rays. Label them.

**The Earth's Shadow**

3) Divide the earth in half by a vertical diameter (twilight line) through its center. From the ends of the diameter, draw horizontal lines to the right edge of the paper to mark off the earth's shadow. Lightly shade the night half of the earth and its shadow. Just inside the earth, label Noon, Sunset, Midnight, and Sunrise at the proper points.



b) visible at dawn or dusk, as compared with Vanguard .....

c) visible at night .....

d) visible by day .....

9) *Vanguard I* is less than 2 feet in diameter. *Echo I*, the balloon satellite, is 100 feet in diameter. How do these dimensions affect their relative visibility, considering their orbits?

10) *Visibility of Satellite X*. How does the greater distance of Satellite X from the earth affect its visibility, as compared with *Vanguard* and *Echo*?

**Visibility of the Moon**

11) Why is our natural moon affected so little by the earth's shadow that it is eclipsed only a few times a year?

**A Satellite's Period of Revolution**

12) *Vanguard* revolves around the earth about once every two hours. How does this affect its visibility from the standpoint of a) duration at any one time .....

b) different places on the earth. ....

Evaluation Form for Teachers

1. Name of the mini course \_\_\_\_\_
2. Was this unit appropriate to the level of your students?
3. Explain how this mini course was used with your students. (Individual, small group, or total class)
4. Identify the plus factors for this course.
5. List the changes that you would recommend for improvement.
7. Did you use any other valuable resources in teaching this unit? If so, please list.

PLEASE RETURN TO SCIENCE SUPERVISOR'S OFFICE AS SOON AS YOU COMPLETE THE COURSE.

ADDITIONAL SCIENCE MINI-COURSES

LIFE SCIENCE

Prepared by

A Study for the Birds . . . . .	Terrence Best
Creepy Critters (Snakes). . . . .	Terrence Best
How's Your Plumbing? . . . . .	Paul Cook
Guess Who's Been Here for Dinner. . . . .	Paul Cook
Plants - The "Other" Living Things. . . . .	Sharon Sheffield
Let's Look at You - The Human Organism . . . . .	Sharon Sheffield
Classification: Why is There a Need?. . . . .	Melvin Whitfield
Protist: The "Unseen" Kingdom . . . . .	Melvin Whitfield

EARTH SCIENCE

Coastline Development . . . . .	Nelson Ford
Ocean Currents . . . . .	John Fradiska
Features of the Ocean Floor (Ocean Floor Topography). . . . .	John Fradiska
Space and Its Problems. . . . .	John Geist
Invertebrate Fossils: Clues to the Distant Past . . . . .	John Geist
An Attempt towards Independent Study in Astronomy . . . . .	John Geist

PHYSICAL SCIENCE

Household Chemistry . . . . .	Ross Foltz
Notions on Motions . . . . .	Kenneth Howard
Environmental Chemistry . . . . .	Fred Meyers